

AD-4157 291

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS  
LAKE MADELEINE 1V1 00...1U1 CORPS OF ENGINEERS WALTHAM  
MA NEW ENGLAND DIV SEP 78

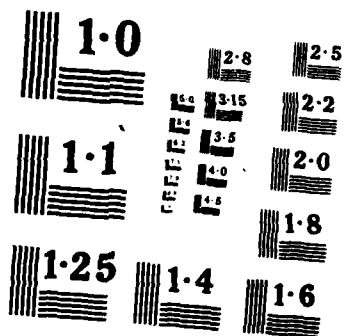
1/1

UNCLASSIFIED

F/G 13/13

NL

END  
DATE  
FILMED  
9 '85



AD-A157 291

**HUDSON RIVER BASIN  
SANDGATE**

**LAKE MADELEINE  
VT 00007**

**PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM**



**DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
WALTHAM, MASS. 02154**

**DTIC  
ELECTE**  
JUL 17 1985  
S G

**SEPTEMBER 1973**

**FOR FILE COPY**

**REPRODUCTION RESTRICTIONS**  
Approved for public release  
Distribution Unlimited

**UNCLASSIFIED**

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER VT00007	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle)  Lake Madeleine  NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED  INSPECTION REPORT
7. AUTHOR(s)  U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE September 1978
		13. NUMBER OF PAGES 48
		15. SECURITY CLASS. (of this report)  UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report)  APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)  DAMS, INSPECTION, DAM SAFETY,  Hudson River Basin Sandgate, VT Hopper Brook		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  The dam is about 1700 ft. long and 50 ft. high. The dam is intermediate in size with a low hazard potential. The test flood for the dam is the 100 year flood. The flood will not overtop the dam. The dam and appurtenant structures are in good condition. It is recommended that the brush in the channel downstream of the emergency spillway be cut and removed. All aspects of the maintenance and operation program should continue to ensure that the dam and its appurtenances remain in good condition.		

## **DISCLAIMER NOTICE**

**THIS DOCUMENT IS BEST QUALITY  
PRACTICABLE. THE COPY FURNISHED  
TO DTIC CONTAINED A SIGNIFICANT  
NUMBER OF PAGES WHICH DO NOT  
REPRODUCE LEGIBLY.**



DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
424 TRAPELO ROAD  
WALTHAM, MASSACHUSETTS 02154

REPLY TO  
ATTENTION OF:

NEDED-E

Father Raphael Diamond, Prior  
Charterhouse of the Transfiguration  
Arlington, Vermont 05250

Dear Father Diamond:

Forwarded herewith for your information and use is a copy of the Inspection Report on the Lake Madeleine. This inspection was made under the authority of Public Law 92-367 by the firm of Dufresne-Henry Engineering Corporation, Springfield, Vermont, under the direction and supervision of the Corps of Engineers. A copy of the finished report has been forwarded to the Governor and the Department of Water Resources, the cooperating agency for the State of Vermont.

Section 7 of the report contains an evaluation and recommendations. If you have any questions concerning this report, contact the Department of Water Resources first. Then, if there are further questions contact the Project Management Branch, Engineering Division of this office. We thank you for your cooperation and assistance in carrying out this program.

Sincerely yours,

*Joe B. Fryar*

JOE B. FRYAR  
Chief, Engineering Division

Incl  
As Stated

Accession For	
NTIS GRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A/1	23 CNI



LAKE MADELEINE DAM

VT00007

SANDGATE, VERMONT

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM  
PHASE I INSPECTION REPORT

Identification No.: VT00007  
Name of Dam: Lake Madeleine  
Town: Sandgate  
County and State: Bennington County, Vermont  
Stream: Hopper Brook  
Date of Inspection: August 1, 1978

BRIEF ASSESSMENT

Lake Madeleine was constructed for electrical power generation. This facility consists of a dam approximately 1700 feet long, 50 feet high on its southeast shore and a dike 850 feet long, 30 feet high on the north shore. The dam and dike have crest elevations of 2185 MSL, recreational pool is 2179 MSL; surface area is normally 35 acres with a drainage area of 340 acres.

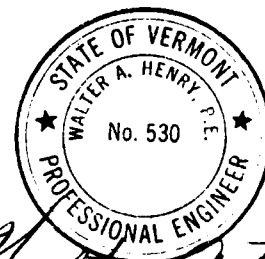
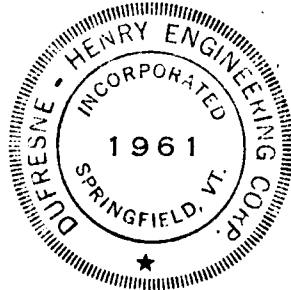
This dam is of "intermediate" size with a hazard classification of "low". In accordance with "Recommended Guidelines for Safety Inspection of Dams, Department of the Army November 1976" the test flood for this dam is the 100-year flood. This flood will not overtop the dam.

The valve tower provides control for a 16-inch diameter penstock which leads to a power station approximately 11,000 feet downstream.

There is a 16-inch diameter overflow pipe near the left abutment of the dam and an emergency spillway near the left abutment of the dike.

The dam and appurtenant structures are in good condition.

It is recommended that the brush in the channel downstream of the emergency spillway be cut and removed, the grasses upstream of the channel be cut, and that this channel be maintained in a cleared condition within two years of the receipt of this Phase I Inspection Report. All aspects of the maintenance and operation program should continue to ensure that the dam and its appurtenances remain in good condition.



*Walter A. Henry*

This Phase I Inspection Report on Lake Madeleine has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.



CHARLES G. TIERSCH, Chairman  
Chief, Foundation and Materials Branch  
Engineering Division

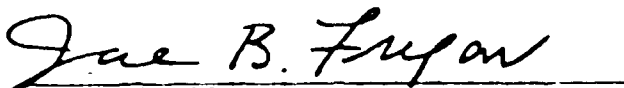


FRED J. RAVENS, Jr., Member  
Chief, Design Branch  
Engineering Division



SAUL COOPER, Member  
Chief, Water Control Branch  
Engineering Division

APPROVAL RECOMMENDED:



JOE B. FRYAR  
Chief, Engineering Division

## PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

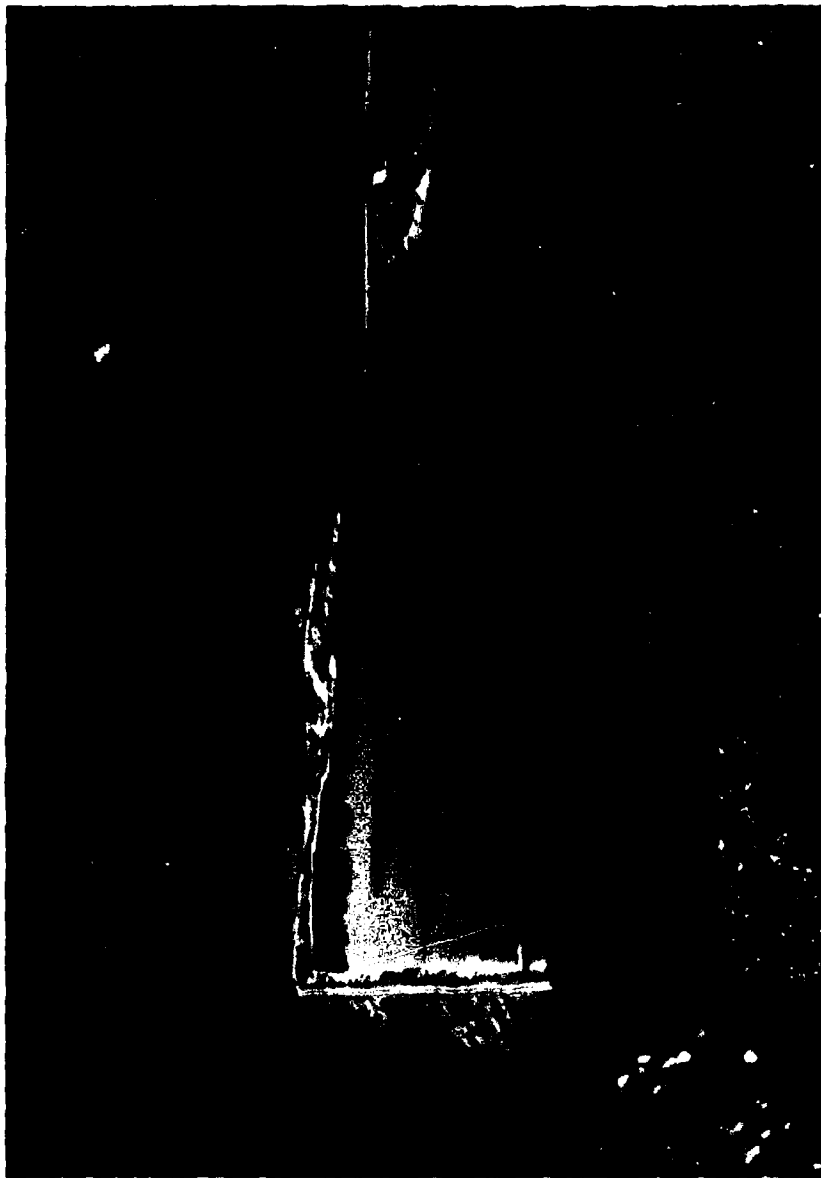
Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

## TABLE OF CONTENTS

	<u>Page</u>
REVIEW BOARD PAGE	iii
PREFACE	iv
TABLE OF CONTENTS	v
TABLE OF CONTENTS	vi
TABLE OF CONTENTS	vii
OVERVIEW PHOTO	viii
LOCATION MAP	ix
REPORT	
SECTION 1 - PROJECT INFORMATION	1
1.1 GENERAL	1
a. Authority	1
b. Purpose	1
1.2 DESCRIPTION OF PROJECT	1
a. Location	1
b. Description of Dam and Appurtenances	2
c. Size Classification	2
d. Hazard Classification	2
e. Ownership	2
f. Operator	3
g. Purpose	3
h. Design and Construction History	3
i. Normal Operation Procedure(s)	3
1.3 PERTINENT DATA	4
a. Drainage Area	4
b. Discharge at Dam Site	4

	<u>Page</u>
c. Elevation	4
d. Reservoir Data	5
e. Storage Data	5
f. Reservoir Surface	5
g. Dam	5
i. Spillway	6
j. Regulating Outlets	6
SECTION 2 - ENGINEERING DATA	7
2.1 DESIGN	7
2.2 CONSTRUCTION	7
2.3 OPERATION	7
2.4 EVALUATION	7
a. Availability	7
b. Adequacy	7
c. Validity	7
SECTION 3 - VISUAL INSPECTION	8
3.1 FINDINGS	8
a. General	8
b. Dam	8
c. Appurtenant Structures	9
d. Reservoir Area	9
e. Downstream Channel	9
3.2 EVALUATION	10
SECTION 4 - OPERATIONAL PROCEDURES	11
4.1 PROCEDURES	11
4.2 MAINTENANCE OF DAM	11
4.3 MAINTENANCE OF OPERATING FACILITIES	11
4.4 DESCRIPTION OF WARNING SYSTEM IN EFFECT	11
4.5 EVALUATION	11
SECTION 5 - HYDRAULIC AND HYDROLOGIC EVALUATION	12
5.1 EVALUATION OF FEATURES	12
a. Design Data	12
b. Experience Data	12
c. Visual Observation	12
d. Overtopping Potential	12
e. Results of Dam Failure	12

	<u>Page</u>
SECTION 6 - STRUCTURAL STABILITY	13
6.1 EVALUATION OF STRUCTURAL STABILITY	13
a. Visual Observations	13
b. Design and Construction Data	13
c. Operating Records for the Dam	13
d. Post-Construction Changes	13
e. Seismic Stability	14
SECTION 7 - ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES	15
7.1 DAM ASSESSMENT	15
a. Condition	15
b. Adequacy of Information	15
c. Urgency	15
d. Necessity for Additional Investigations	15
7.2 RECOMMENDATIONS	15
7.3 REMEDIAL MEASURES	15
a. Alternatives	15
b. O & M Maintenance & Procedures	16
APPENDIX A	
Visual Inspection Check List	
APPENDIX B	
Project Records and Plans	
APPENDIX C	
Photographs	
APPENDIX D	
Hydraulic Computations	
APPENDIX E	
Information as Contained in the National Inventory of Dams	



LAKE MADELEINE DAM  
SANDGATE, VERMONT

## SECTION 6: STRUCTURAL STABILITY

### 6.1 Evaluation of Structural Stability

#### a. Visual Observations

The visual inspection did not disclose any findings indicating stability problems.

#### b. Design and Construction Data

The "as-built" drawings for the dam prepared by Haley and Aldrich Consultants of Cambridge, Massachusetts indicate an homogeneous dam with internal drainage consisting of a chimney drain, drainage blanket and toe drains. The chimney drain is not continuous but consists of 4-foot wide sand columns 20 feet on centers. The seepage observations indicate that the drainage features are effective in preventing seepage from exiting through the downstream slope of the dam. Stability analyses performed by the designers indicate that the dam is stable under steady flow conditions, but the designers warned that it would not be stable under rapid drawdown conditions. A review of the stability analyses indicated that the basic assumptions were sufficiently conservative and that no stability problems exist unless rapid drawdown were to occur.

#### c. Operating Records

Cracks have been reported to have developed in the valve tower in 1962 and 1971, accompanied by lateral movements of the tower, leading in 1962 to repairs consisting of tierods between the tower and a deadman within the dam. The cause of these problems was not apparent from a review of the records.

The seepage out of the downstream toe has been a subject of concern since filling of the reservoir because of the loss of water and potential generating power. A partial impervious blanket was placed, apparently in the early '60s, to decrease the seepage volume reportedly with partial success. As discussed in Section 6.1.b, the seepage is not of concern from the point of view of stability of the dam.

#### d. Post-Construction Changes

The records indicate no post-construction changes which are significant for the safety of the dam. The available records indicate the following changes:

## SECTION 5: HYDRAULIC/HYDROLOGIC

### 5.1 Evaluation of Features

#### a. Design Data

There was no design data available for the hydrology of Lake Madeleine.

#### b. Experience Data

Lake Madeleine Dam has not been overtopped or failed since its construction in 1958.

#### c. Visual Observations

The areas up and downstream of the emergency spillway are in need of better maintenance.

#### d. Overtopping Potential

The test flood (100-year flood) was developed using criteria set forth in the Soil Conservation Service Engineering Field Manual. For a peak outflow of 880 cfs (1660 csm) the lake will rise to about elevation 2181.5 which is 3.5 feet below the top of the dam.

The Lake Madeleine Dam is not in danger of being overtopped by the test flood.

#### e. Results of Dam Failure

In the event of a sudden dam failure a flood wave 40 feet high would leave Lake Madeleine. This wave would destroy the pump and power houses associated with the hydroelectric complex and the local private access roads to these buildings and the Charterhouse of the Transfiguration. The homes along the lower reaches of Hopper Brook are built away from the stream and the flood wave would diminish rapidly where it entered the Green River above Sandgate.

## SECTION 4: OPERATIONAL PROCEDURES

### 4.1 Procedures

Lake Madeleine dam is used to store water from the spring snowmelt in order to produce hydroelectric power in the summer when the streams are low. Generally the valve in the pipe leading from Lake Madeleine to the turbine is left cracked so that the turbine and generator remain active and produce about 15 horsepower of electricity. This amount of power is used to pump the water which escapes out of the toe drain, and also surface water which collects near the toe of the dam back into the Lake. The idea is to keep Lake Madeleine as full as possible. Historically the Lake has always reached the spillway elevation in June.

In the latter part of the summer the valve is opened and the Lake Madeleine generating station is used to augment the power production from another generating station. Lake Madeleine may be drawn down as much as 16 feet before the late fall rains begin. When precipitation is back to normal the level in Madeleine is maintained as high as possible through the winter without creating any substantial changes in the level of the lake ice.

### 4.2 Maintenance of the Dam

The dam is reportedly inspected weekly to identify any unusual conditions. The brush on the face of the dam and dike is cut during the summer months. The dam and dike have a good grass cover which is not mowed to prevent "burning" of the grass.

### 4.3 Maintenance of Operating Facilities

The operating facilities are maintained as necessary by the Superintendent of Maintenance. Because this is an operating hydro-power facility, the operating appurtenances are kept in workable condition.

### 4.4 Description of Warning System in Effect

None exists for this dam.

### 4.5 Evaluation

The maintenance and operational procedures in effect at Lake Madeleine Dam are good. It is recommended that the area immediately downstream of the spillway be kept cleared of brush.

### 3.2 Evaluation

Based on visual inspection the dam and appurtenant structures are in good condition.

Cut the brush downstream of the paved section of the emergency spillway; clean up weeds upstream of the emergency spillway.

The only negative finding is that there is brush growing upstream and downstream of the emergency spillway which could impair the discharge capabilities of the spillway.

The dike at the north side of the lake shows grass cover over the crest and downstream slope and riprap on the upstream slope (see Photo #6). No evidence of erosion gullies, sloughing or wet area was observed on the downstream slope of the dam. The crest and the upstream slope are in good condition. About 100 feet downstream of the dike a wet area was found in what appears to be an old creek bed.

c. Appurtenant Structures

The valve tower (see Photo #4) was flooded and according to the owner's representative, it is kept flooded. When it is intended to drain the tower, a drain pipe is opened from the downstream toe of the dam. The exposed portion of the valve tower is in good condition, however the service bridge is tilted and the footing for the service bridge is missing.

There is a 16-inch diameter overflow pipe (see Photo #5) located near the left abutment; the elevation of this is .2 feet below that of the emergency spillway. There is not enough of the overflow pipe exposed to judge its condition.

The emergency spillway (see Photo #7) is located in the north dike. It is a paved channel at the dike crest which is in good condition, but the channel downstream of the dike has a growth of bushes up to about 15 feet which would impair flow.

d. Reservoir Area

Brush on the face of the dam was being cut and the lake was at elevation 2178.5 as recorded on the staff gage attached to the access tower. The approach channel to the emergency spillway has some weed growth which should be clipped when the lake is drawn down.

e. Downstream Channel

The channel of Hopper Brook is clear of any debris and so low as to have no impact on the release of flood flows from the lake.

The channel downstream of the emergency spillway has become vegetated to the point where it will interfere with the release of floods from the lake. The thick brush can cause the lake to rise one foot above what it would if only the bituminous concrete roadway section were to control.

## SECTION 3: VISUAL INSPECTION

### 3.1 Findings

#### a. General

In general the condition of Lake Madeleine is good. The earth embankments which form the dam and dike show no evidence of erosion or settlement. All slopes were grass covered and riprap sections were in good condition.

#### b. Dam

At the time of inspection, the water elevation was 2178.5, which is 6.5 feet below the crest of the dam. The exposed upstream slope is covered with riprap with the exception of the upper 2 feet or so where it is grass covered (see Photo #2). The riprap is in good condition, and no evidences of erosion were observed in the grass-covered slope. The bridge connecting the crest to the gatehouse structure has settled at the dam's end, probably as a result of ice pressure (see Photo #4).

The crest of the dam is grass-covered with no evidence of erosion or cracking and also provides a travel way for service and maintenance vehicles, (see Photo #3).

The downstream slope is covered with grass with no evidence of erosion or sloughing. No evidence of trespassing was observed with the exception of tracks of a four-wheel vehicle at one location. No wet areas were observed when traversing along the downstream slope. Particular attention was paid to the slope at the elevation of the "cobble gutter" and immediately above the coarse gravel toe drain. Seepage was observed exiting along the base of the toe drain, creating a large wet area between the road and the dam. The water flows under the road through a 1-foot diameter corrugated metal pipe into a small collection pond from where it is pumped back into the reservoir. In some parts of the wet area, there is evidence of iron staining which becomes apparent as the water enters the drain pipe. Another wet area was observed immediately downstream of the dam in a topographical low at the right abutment. However, the water in this area does not necessarily originate from seepage under or through the dam but probably from natural drainage of right abutment. A general view of the downstream slope is shown in Photo #4.

## SECTION 2: ENGINEERING DATA

### 2.1 Design

There is available information relating to the structural design of the dam consisting of stability analysis, soil tests, boring logs, geological site reconnaissance, and seepage analysis. This information is available at the offices of Haley and Aldrich Consulting Engineers in Cambridge, Massachusetts.

### 2.2 Construction

As-built plans of the dam are available for review.

### 2.3 Operation

Lake Madeleine is operated for the purpose of producing electricity. A detailed narrative of the operation of the dam is given in Section 4. In summary, the lake generally is filled by the month of June from snowmelt, and is drawn down as much as 16 feet in August and September due to power generation. Since the dam was built, a record has been kept of the water level in the lake. In that period the spillway has been sufficient to maintain the water level well below the crest of the dam.

### 2.4 Evaluation

#### a. Availability

As-built plans were made available through the operator of the facility and the design data is available as noted in Section 2.1.

#### b. Adequacy

Sufficient data are available for a Phase I inspection.

#### c. Validity

The available engineering data are considered valid based on the results of the visual inspections.

(8) Cutoff

There is a cutoff trench provided.

(9) Grout Curtain

There is no grout curtain indicated.

i. Spillway

(1) Type

Trapezoidal, bituminous-concrete board-crested weir.

(2) Length

50 feet level with 56 feet each end at 1:10.

(3) Crest Elevation

2179.2

(4) Gates

None.

(5) Upstream Channel

Shallow with weed growth established.

(6) Downstream Channel

Grown over with young poplar and willows, thick brush.

j. Regulating Outlets

The penstock can be by-passed at the power house to provide the release of water from the lake. The flow is controlled by a gate valve, invert elevation 2131. The intake to the penstock is protected by trash racks covering four 4' x 6' openings with invert elevations at 2135.

d. Reservoir Data

Feet

Length of Pool 1000

e. Storage Data

Acre-Feet

Top of Dam 873

Design Surcharge 750

Recreation Pool 663

f. Reservoir Surface

Acres

Top of Dam 35

Maximum Pool 35

Recreation Pool 35

g. Dam

(1) Type

This dam is of homogeneous earth fill with chimney drains. The dike is an homogeneous earth fill dam.

(2) Length

The dam is 1700 feet long.

The dike is 850 feet long.

(3) Height

The dam has a structural height of 70 feet.

The dike has a structural height of 30 feet.

(4) Top Width

The top width of both the dam and dike is 14 feet.

(5) Side Slopes

The dam upstream - 2H:1V

The dam downstream - 2H:1V

The dike upstream - 2H:1V

The dike downstream - 2H:1V

(6) Zoning

There is no evidence of zoning of this dam except for the sand chimney drains and sand blanket.

The dike apparently has no zoning.

(7) Impervious Core

There is no impervious core.

### 1.3 Pertinent Data

#### a. Drainage Area

The watershed for Lake Madeleine is the headwaters of Hopper Brook on the west side of Mt. Equinox. The land slopes are steep, being on the order of 28 per cent. The land is covered with good forest and is described by the Soil Conservation Service to be predominantly of the Nassau-Dutchess group. These soils are steep, shallow and well drained on slate uplands. The hydrologic soil group used for the flood flow computations was C. There are 180 acres of original watershed and an additional 160 acres which were diverted into the lake, making a total of 340 acres (0.53 square miles).

#### b. Discharge at Dam Site

##### (1) Outlet Works

There are three outlets from Lake Madeleine. They are: the penstock, the overflow pipe and the emergency spillway. The primary outlet used for power generation is the 16-inch diameter penstock. The penstock inlet invert is at elevation 2131 and falls to approximately 1804 at the turbine near Hopper Pond running over a distance of about 4000 feet from Lake Madeleine. The overflow pipe is a 16-inch diameter steel pipe set vertically on the face of the dam. The crest of this pipe is close to elevation 2179 and falls to its outlet on the downstream face at elevation 2149 over a distance of three hundred feet. The emergency spillway is a paved section on the north side of the lake. The primary element is at elevation 2179.2 and is 50 feet long by 20 feet wide. The ends rise at a 1:10 slope, 15 feet away from the central portion. The flows then pass through a cobble-paved section into the forest.

##### (2) Maximum Known Flood at Dam Site

There is no record of maximum floods at this site.

##### (3) Ungated Spillway Capacity

At the top of dam elevation (2185) the emergency spillway has a capacity of 4000 cfs.

#### c. Elevation Data

	<u>Elevation (feet above MSL)</u>
Top of Dam	2185
Maximum Pool - design surcharge	~ 2181.5
Spillway Crest	2179.2
Recreation Pool	2179
Streambed at Centerline of Dam	2121

Father Raphael Diamond, Prior  
Charterhouse of the Transfiguration  
Arlington, Vermont 05250

Telephone 802-362-2550

Father Diamond's representative is:

Mr. Frederick Harvey  
Shaftsbury, Vermont 05262

Telephone 802-442-6962

The previous owner of the dam was Dr. Joseph G. Davidson. Prior to his death in 1969, Dr. Davidson received much local notoriety, partially due to his vast land holdings on Mt. Equinox and partially due to his reputation as an inventor and engineer. Dr. Davidson personally conceived the idea for Lake Madeleine Dam and undertook the construction of the dam.

f. Operator

The operation of the dam is supervised by Mr. Burt Smith, Superintendent of Maintenance. Mr. Smith has his residence on Mt. Equinox and can be considered a full-time operator. His address is:

Mr. Burt Smith  
Equinox Sky Line Drive  
Manchester, Vermont 05354

Telephone 802-362-1111

g. Purpose

The pond is a storage reservoir for power generation.

h. Design and Construction History

The Lake Madeleine Dam was designed in 1956 by the firm of Haley and Aldrich. The plans were submitted to and reviewed by the State of Vermont and in March of 1957 the State Water Conservation Board granted permission to build the facility. As-built plans were compiled during the construction phase.

i. Normal Operating Procedure(s)

A detailed discussion of the operating procedures for the dam is presented in Chapter 4. In general the dam is kept as full as possible with snowmelt in the spring months, and is used to produce hydropower in the summer months.

b. Description of Dam and Appurtenances

The dam, located on the southwest end of the impoundment, is an earth fill type that is approximately 1700 feet long, 70 feet high and has a top width of 14 feet.

There is a dike located on the north side of the impoundment that is approximately 850 feet long, 30 feet high and has a top width of 14 feet.

The dam and dike have top elevations of 2185.

There is an emergency spillway on the north edge of the impoundment which has a centerline elevation of 2179.2 feet MSL, 5.8 feet below the top of the dam and dike embankments.

There is a 16" diameter steel pipe located near the left end of the dam which provides an overflow outlet and is set at elevation 2179. This overflow discharges into Hopper Brook.

Located approximately 300 feet from the left abutment is the valve tower which is a concrete structure having 4' x 4' inside dimensions and is approximately 54 feet high from its footing. The 16" diameter steel penstock which passes through the valve tower is gated and has a valve stem extension which extends 3-4 feet above the tower.

c. Size Classification

Lake Madeleine is a 35-acre impoundment with a structural height of 70 feet and a maximum storage volume of 873 acre-feet. The Army Corps of Engineers recommends that dams having a storage volume of greater than 1000 acre-feet but less than 50,000 acre-feet or a height of greater than 40 feet but less than 100 feet be classified as intermediate in size. In the case of Lake Madeleine Dam the height governs and the dam is classified as intermediate in size.

d. Hazard Classification

The hazard classification is "low." There are no structures for human habitation that would be lost in the event of a failure.

e. Ownership

The owner of Lake Madeleine Dam is the Carthusian Foundation. The Carthusian Foundation is the business organization of a religious order that maintains a monastery adjacent to the dam. The contact for the Carthusian Foundation is:

NATIONAL DAM INSPECTION PROGRAM  
PHASE I INSPECTION REPORT  
NAME OF DAM: LAKE MADELEINE

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Dufresne-Henry Engineering Corporation has been retained by the New England Division to inspect and report on selected dams in the State of Vermont. Authorization and notice to proceed were issued to Dufresne-Henry Engineering Corporation under a letter of May 26, 1978 from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0341 has been assigned by the Corps of Engineers for this work.

b. Purpose

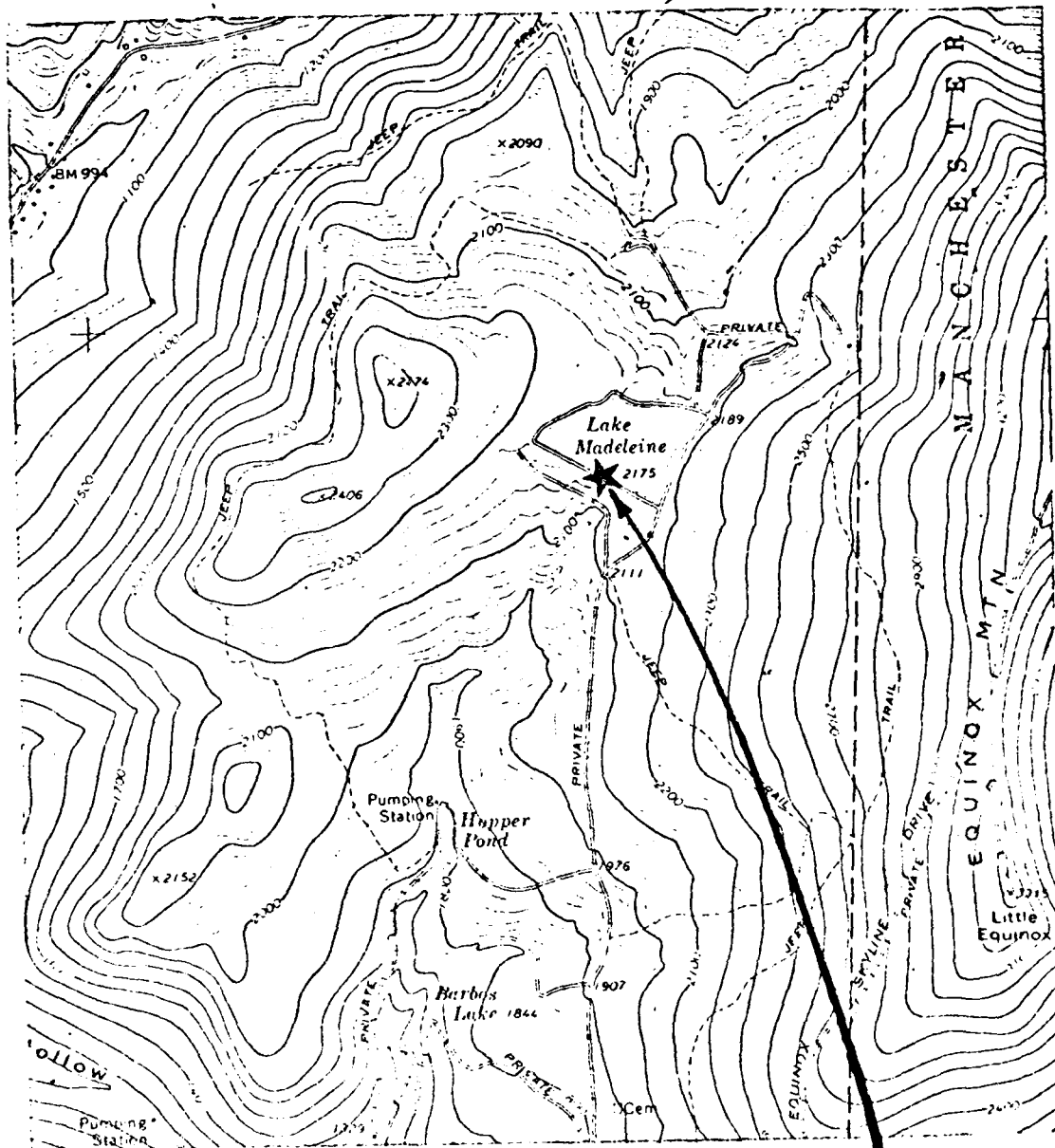
1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
2. Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.
3. To update, verify and complete the National Inventory of dams.

1.2 Description of Project

a. Location

Lake Madeleine is located in the Town of Sandgate, Bennington County, Vermont, in the southwestern section of the State.

The site is located in the Hudson River Basin on Hopper Brook and is approximately 3-1/2 miles upstream of the confluence of Hopper Brook and the Green River.



# LAKE MADELEINE

## SOURCE OF MAP

US GEOLOGICAL SURVEY  
WEST RUPERT QUADRANGLE  
VERMONT  
7 1/2 MIN. SERIES  
1:24000 1967

CLIENT NO	22-0552	DUFRESNE HENRY ENGINEERING CORP.	
PROJ ENG	MRP	LOCATION MAP	
DRAWN BY	RB	LAKE MADELEINE	
DATE	9-5-78	SANDGATE	VERMONT A 16011

Partial impervious blanket, circa 1960.

Repair of crack in valve tower, 1962.

Widening of the crest of the north dike to allow truck traffic.

e. Seismic Stability

The dam is located in Seismic Zone 2 and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

## SECTION 7: ASSESSMENT, RECOMMENDATIONS/ REMEDIAL MEASURES

### 7.1 Dam Assessment

#### a. Condition

Lake Madeleine dam and the dike are in good condition. The visual inspection and review and a review of the As-Built drawings did not disclose any findings that indicate any unsafe conditions. Preliminary calculations indicate that the dam would not overtop during the test flood (100-year storm). The following items were noticed, and require attention as discussed in Section 7.3.:

1. The service bridge is tilted and misaligned and lacks adequate foundation.
2. The drain on the valve tower was not open.
3. Brush is growing in the area of the emergency spillway.

#### b. Adequacy of Information

The information available is such that the assessment of the condition of the dam must be based on the visual inspection, As-Built drawings, past performance history and preliminary hydraulic and hydrologic computations.

#### c. Urgency

There is no condition which requires immediate attention. The remedial measures recommended in 7.3. should be implemented within two years of receipt of this Phase I Inspection Report.

#### d. Necessity for Additional Investigations

Further investigation of this dam, dike and appurtenances is not necessary.

### 7.2 Recommendations

None, except as noted under Section 7.3.

### 7.3 Remedial Measures

#### a. Alternatives

Not applicable.

**b. Operating and Maintenance Procedures**

1. The maintenance procedure noted in Section 4.2 should be continued, and should be expanded to include the following items:
  - a. Clearing of brush from the area of the emergency spillway channel.
  - b. Drainage and inspection of the valve tower annually.
  - c. Periodically inspect and realign the service bridge including the bridge railing.
2. A technical inspection should be performed bianually.
3. The people responsible for the operation of the dam should be made aware of the designer's recommendation that rapid drawdown of the reservoir should not be allowed to take place.

**APPENDIX A**  
**VISUAL INSPECTION CHECK LIST**

VISUAL INSPECTION CHECK LIST  
PARTY ORGANIZATIONPROJECT LAKE MADELEINE DAMDATE August 1, 1978TIME 10:30WEATHER Overcast

W.S. ELEV. \_\_\_\_\_ U.S. \_\_\_\_\_ DN.S. \_\_\_\_\_

PARTY:

1. <u>W. A. Henry</u>	<u>D-H</u>	6. _____
2. <u>M. J. Root</u>	<u>D-H</u>	7. _____
3. <u>J. R. Spencer</u>	<u>D-H</u>	8. _____
4. <u>M. R. Peloso</u>	<u>D-H</u>	9. _____
5. <u>G. Castro</u>	<u>GEI</u>	10. _____

## PROJECT FEATURE

## INSPECTED BY

## REMARKS

1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____
5. _____	_____	_____
6. _____	_____	_____
7. _____	_____	_____
8. _____	_____	_____
9. _____	_____	_____
10. _____	_____	_____

## PERIODIC INSPECTION CHECK LIST

2 of 9

PROJECT LAKE MADELEINE DAM

DATE August 1, 1978

PROJECT FEATURE Earth Dam Embankment

NAME G. Castro

DISCIPLINE

NAME

AREA EVALUATED	CONDITION
<u>DAM EMBANKMENT</u>	
Crest Elevation	2185 MSL
Current Pool Elevation	2179.5 MSL
Maximum Impoundment to Date	
Surface Cracks	None apparent.
Pavement Condition	None.
Movement or Settlement of Crest	None observable.
Lateral Movement	None observable.
Vertical Alignment	Too irregular to judge.
Horizontal Alignment	Too irregular to judge.
Condition at Abutment and at Concrete Structures	No concrete structures. Good condition at abutments.
Indications of Movement of Structural Items on Slopes	None apparent.
Trespassing on Slopes	A trail made by road vehicles on downstream slope.
Sloughing or Erosion of Slopes or Abutments	None apparent.
Rock Slope Protection - Riprap Failures	Riprap in good condition.
Unusual Movement or Cracking at or near Toes	None apparent.
Unusual Embankment or Downstream Seepage	Seepage from toe drain.
Piping or Boils	None observed.
Foundation Drainage Features	No foundation drainage indicated in drawings.
Toe Drains	Toe drain present.
Instrumentation Systems	None apparent.
Vegetation	Crest and downstream slope are grass covered.

## PERIODIC INSPECTION CHECK LIST

3 of 9

PROJECT LAKE MADELEINE DAMDATE August 1, 1978PROJECT FEATURE Earth Dike EmbankmentNAME G. Castro

DISCIPLINE \_\_\_\_\_

NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>DIKE EMBANKMENT</u>	
Crest Elevation	2185 MSL
Current Pool Elevation	2179.5 MSL
Maximum Impoundment to Date	
Surface Cracks	None apparent.
Pavement Condition	None except at emergency spillway where it is in good condition.
Movement or Settlement of Crest	None apparent.
Lateral Movement	None apparent.
Vertical Alignment	Surfaces too irregular to judge.
Horizontal Alignment	Surfaces too irregular to judge.
Condition at Abutment and at Concrete Structures	Good.
Indications of Movement of Structural Items on Slopes	None.
Trespassing on Slopes	None observed.
Sloughing or Erosion of Slopes or Abutments	None observed.
Rock Slope Protection - Riprap Failures	Riprap in good condition.
Unusual Movement or Cracking at or near Toes	None observed.
Unusual Embankment or Downstream Seepage	None.
Piping or Boils	None observed.
Foundation Drainage Features	None apparent.
Toe Drains	None apparent.
Instrumentation Systems	None apparent.
Vegetation	Crest and downstream slope are grass covered.

# PERIODIC INSPECTION CHECK LIST

4 of 9

PROJECT LAKE MADELEINE DAM

DATE August 1, 1978

PROJECT FEATURE \_\_\_\_\_

NAME \_\_\_\_\_

DISCIPLINE \_\_\_\_\_

NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u>	
a. Approach Channel	
Slope Conditions	Unobservable.
Bottom Conditions	Unobservable.
Rock Slides or Falls	None.
Log Boom	None.
Debris	None.
Condition of Concrete Lining	None.
Drains or Weep Holes	None.
b. Intake Structure	
Condition of Concrete	None.
Stop Logs and Slots	None.

## PERIODIC INSPECTION CHECK LIST

5 of 9

PROJECT LAKE MADELEINE DAMDATE August 1, 1978

PROJECT FEATURE \_\_\_\_\_

NAME M. R. Peloso

DISCIPLINE \_\_\_\_\_

NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - CONTROL TOWER</u>	
a. Concrete and Structural	
General Condition	Good.
Condition of Joints	Good.
Spalling	None.
Visible Reinforcing	None.
Rusting or Staining of Concrete	None.
Any Seepage or Efflorescence	Some minor seepage.
Joint Alignment	Good.
Unusual Seepage or Leaks in Gate Chamber	Unobservable - water at 12' below top of chamber.
Cracks	None observed.
Rusting or Corrosion of Steel	Gate stem support is good but some rust.
b. Mechanical and Electrical	
Air Vents	None.
Float Wells	None.
Crane Hoist	None.
Elevator	None.
Hydraulic System	None.
Service Gates	None.
Emergency Gates	None.
Lightning Protection System	None.
Emergency Power System	None.
Wiring and Lighting System	None.

# PERIODIC INSPECTION CHECK LIST

6 of 9

PROJECT LAKE MADELEINE DAM

DATE August 1, 1978

PROJECT FEATURE \_\_\_\_\_

NAME \_\_\_\_\_

DISCIPLINE \_\_\_\_\_

NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<p><u>OUTLET WORKS - TRANSITION</u> <u>AND CONDUIT</u></p> <p>General Condition of Concrete</p> <p>Rust or Staining on Concrete</p> <p>Spalling</p> <p>Erosion or Cavitation</p> <p>Cracking</p> <p>Alignment of Monoliths</p> <p>Alignment of Joints</p> <p>Numbering of Monoliths</p>	<p>Outlet pipe is a 16" diameter steel and is an overflow.</p>

## PERIODIC INSPECTION CHECK LIST

7 of 9

PROJECT LAKE MADELEINE DAMDATE August 1, 1978

PROJECT FEATURE \_\_\_\_\_

NAME \_\_\_\_\_

DISCIPLINE \_\_\_\_\_

NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	
General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	
Channel	
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	

## PERIODIC INSPECTION CHECK LIST

8 of 9

PROJECT LAKE MADELEINE DAMDATE August 1, 1978

PROJECT FEATURE \_\_\_\_\_

NAME G. Castro

DISCIPLINE \_\_\_\_\_

NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
b. Weir and Training or Sidewalls	
General Condition of Concrete	
Rust or Staining	
Spalling	
Any Visible Reinforcing	
Any Seepage or Efflorescence	
Drain Holes	
c. Discharge Channel of Emergency Spillway	
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Channel	
Other Obstructions	

Not visible, reservoir full.

None.

Fair.

Fair.

None.

None.

Covered with heavy brush and grass  
vegetation.

## PERIODIC INSPECTION CHECK LIST

9 of 9

PROJECT LAKE MADELEINE DAMDATE August 1, 1978

PROJECT FEATURE \_\_\_\_\_

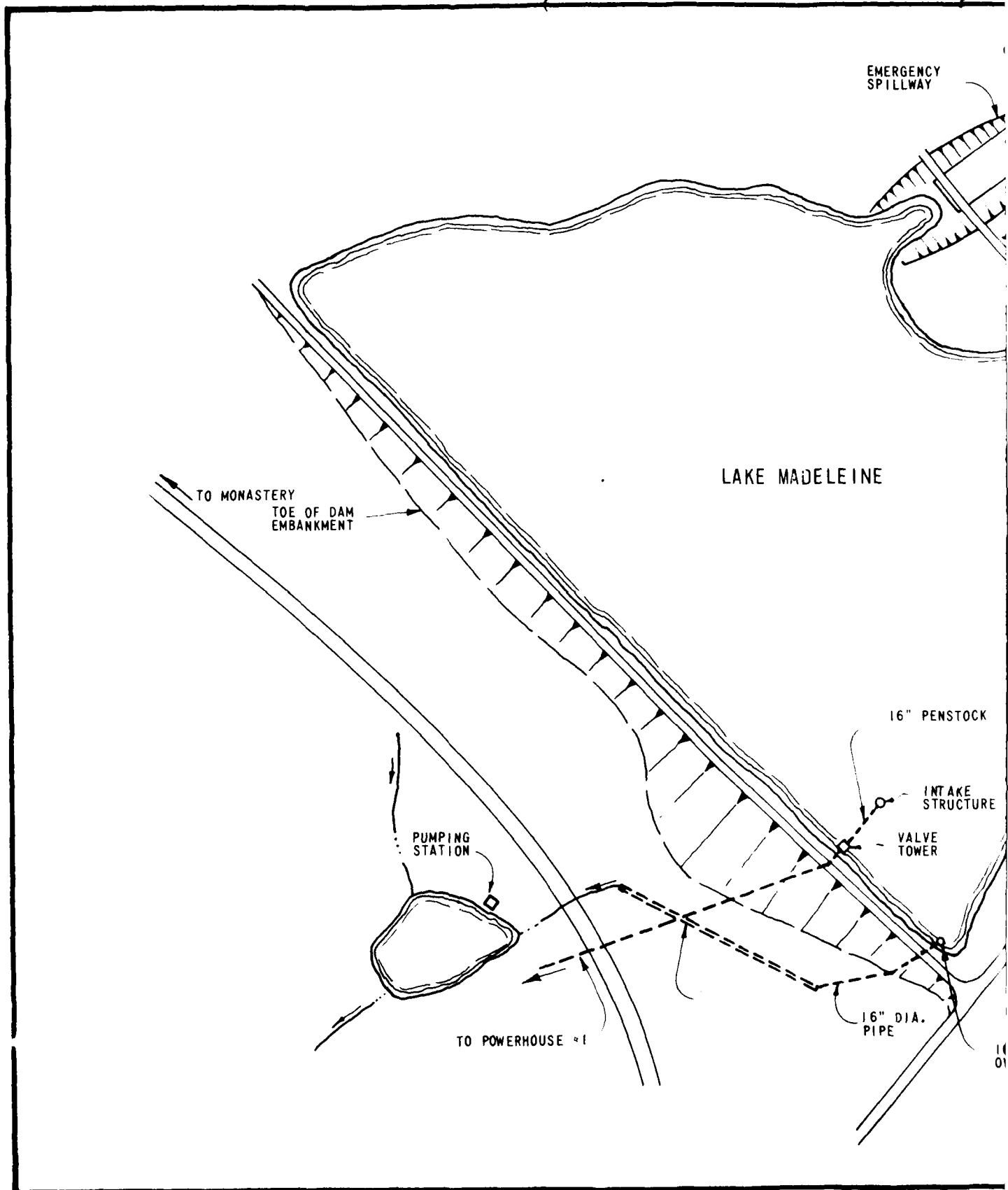
NAME \_\_\_\_\_

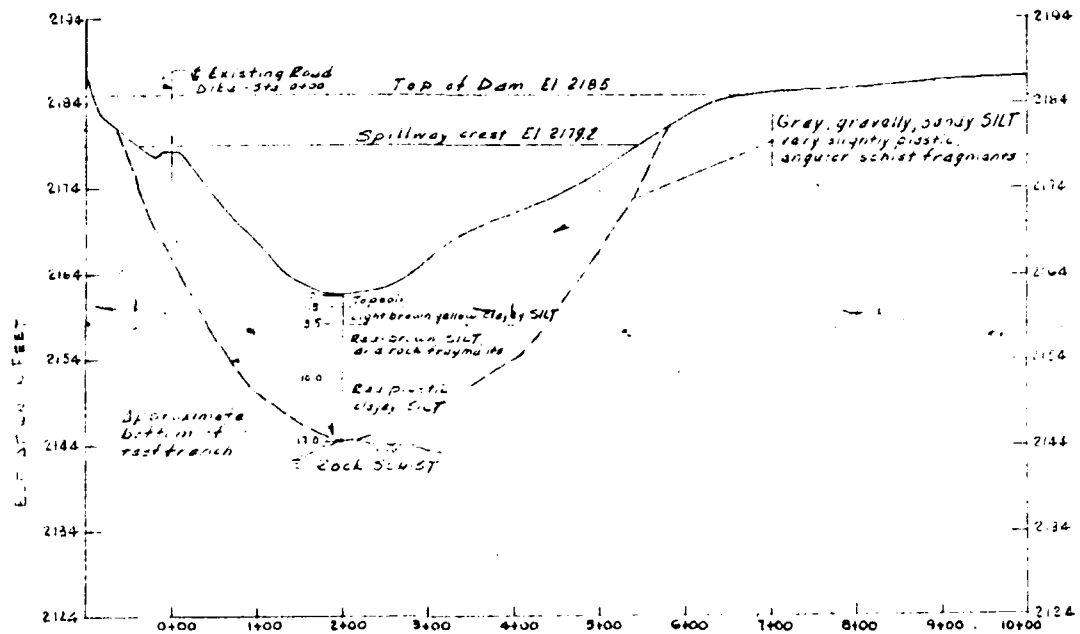
DISCIPLINE \_\_\_\_\_

NAME \_\_\_\_\_

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SERVICE BRIDGE</u>	
a. Super Structure	
Bearings	Good.
Anchor Bolts	None.
Bridge Seat	Good.
Longitudinal Members	2"x 6" 2" x 12"
Under Side-of Deck	Good.
Secondary Bracing	None.
Deck	Good.
Drainage System	None.
Railings	Good. One section broken.
Expansion Joints	None.
Paint	Well Painted.
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	Abutment on dam embankment is out of level due to ice damage.
Approach to Bridge	Good - with hand rail.
Condition of Seat & Backwall	Good.

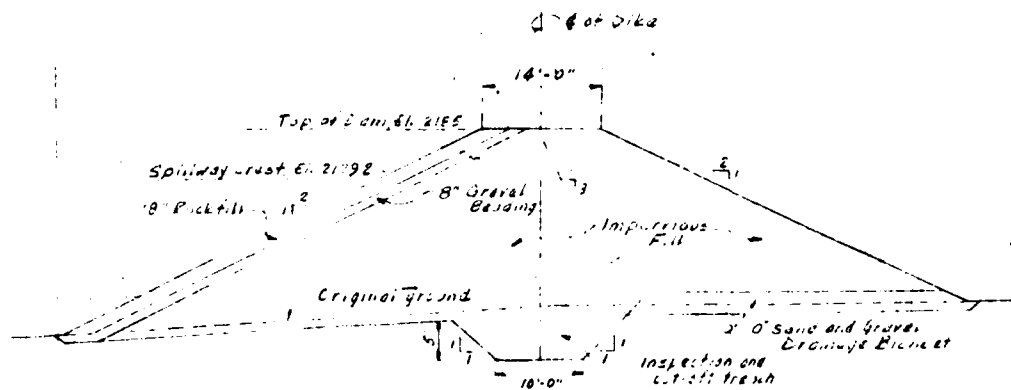
APPENDIX B  
PROJECT RECORDS AND PLANS





### PROFILE ALONG CENTERLINE OF DAM

(LOOKING SOUTHWEST)  
 HORIZ. 1"=100'  
 SCALE - VERT. 1"=10'

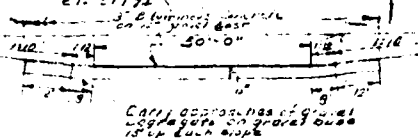


### DIKE CROSS-SECTION

(STA 1+50)  
 SCALE - HORIZ. 1"=10'  
 SCALE - VERT. 1"=10'

Ch. of Springway

Spiliny crust  
El. 11792



(LOOKING NORTHWEST)

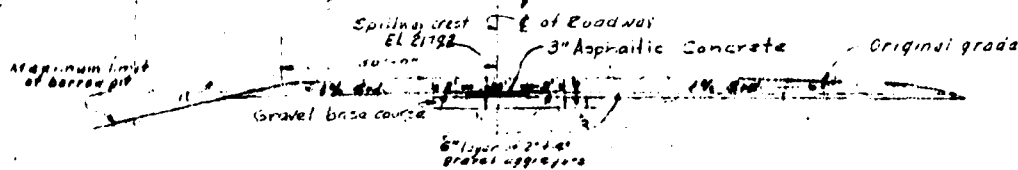
50.1 - HCRZ - 1' = 10'

SCL-2 - HALL - 2 - 10  
VECT - 1" = 20'

Note  
1 Sparrows - 10-12 seen at the top of the hill.  
2 " " 178 seen in the 1st degree  
3 1 smooth banded hawk between the 1st & 2nd degrees

---

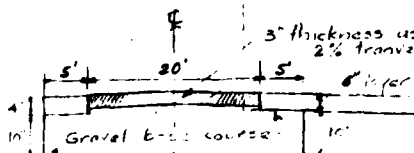
- See Detail A



CENTERLINE PROFILE - SPILLWAY CHANNEL

2404A - H022 1' 20'  
BKT. 1' 20'

3" thickness asphaltic concrete, 1 1/2" binder and 1 1/2" surface course  
2% transverse slope each side of centerline



SECRET

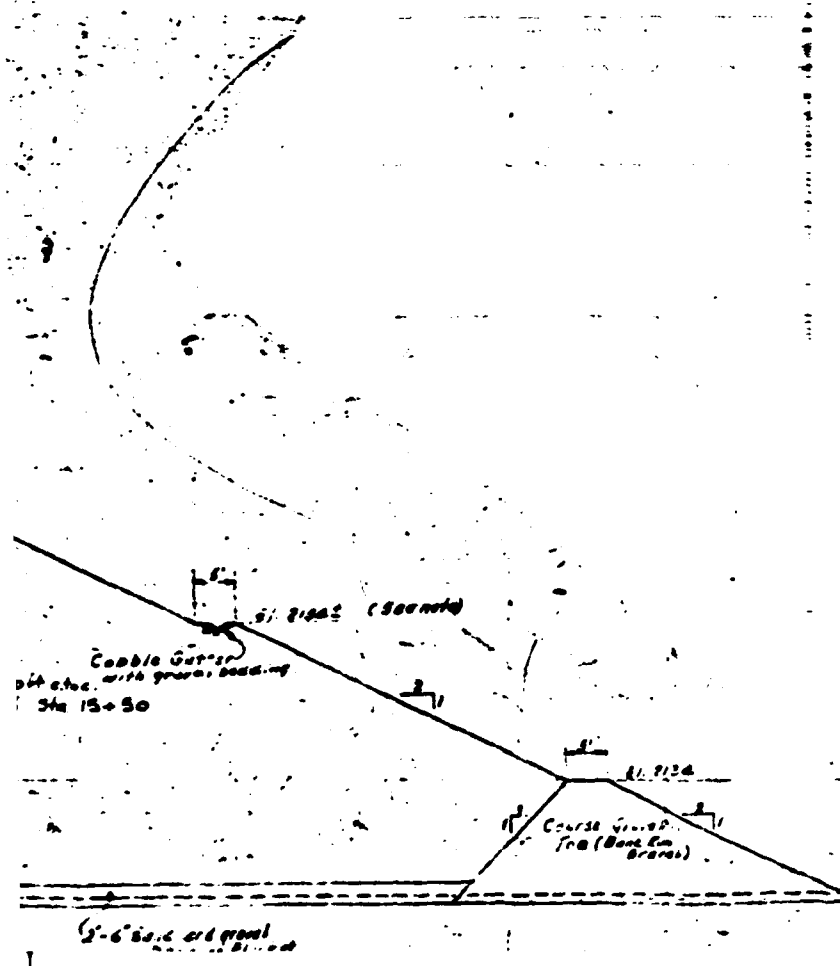
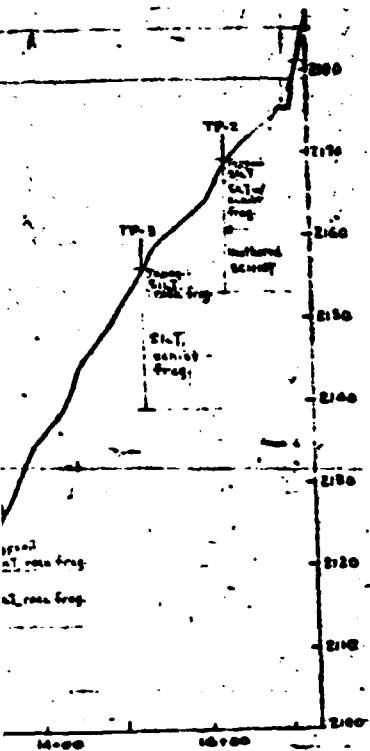
HCP12, SCALE - 1" = 10'

③  
 ⑤  
 ⑥  
 ⑦  
 ⑧  
 ⑨  
 ⑩  
 ⑪  
 ⑫  
 ⑬  
 ⑭  
 ⑮  
 ⑯  
 ⑰  
 ⑱  
 ⑲  
 ⑳  
 ㉑  
 ㉒  
 ㉓  
 ㉔  
 ㉕  
 ㉖  
 ㉗  
 ㉘  
 ㉙  
 ㉚  
 ㉛  
 ㉜  
 ㉝  
 ㉞  
 ㉟  
 ㊱  
 ㊲  
 ㊳  
 ㊴  
 ㊵  
 ㊶  
 ㊷  
 ㊸  
 ㊹  
 ㊺  
 ㊻  
 ㊼  
 ㊽  
 ㊾  
 ㊿  
 0  
 1  
 2  
 3  
 4  
 5  
 6  
 7  
 8  
 9  
 A  
 B  
 C  
 D  
 E  
 F  
 G  
 H  
 I  
 J  
 K  
 L  
 M  
 N  
 O  
 P  
 Q  
 R  
 S  
 T  
 U  
 V  
 W  
 X  
 Y  
 Z  
 AA  
 AB  
 AC  
 AD  
 AE  
 AF  
 AG  
 AH  
 AI  
 AJ  
 AK  
 AL  
 AM  
 AN  
 AO  
 AP  
 AQ  
 AR  
 AS  
 AT  
 AU  
 AV  
 AW  
 AX  
 AY  
 AZ  
 BA  
 BB  
 BC  
 BD  
 BE  
 BF  
 BG  
 BH  
 BI  
 BJ  
 BK  
 BL  
 BM  
 BN  
 BO  
 BP  
 BQ  
 BR  
 BS  
 BT  
 BU  
 BV  
 BW  
 BX  
 BY  
 BZ  
 CA  
 CB  
 CC  
 CD  
 CE  
 CF  
 CG  
 CH  
 CI  
 CJ  
 CK  
 CL  
 CM  
 CN  
 CO  
 CP  
 CQ  
 CR  
 CS  
 CT  
 CU  
 CV  
 CW  
 CX  
 CY  
 CZ  
 DA  
 DB  
 DC  
 DD  
 DE  
 DF  
 DG  
 DH  
 DI  
 DJ  
 DK  
 DL  
 DM  
 DN  
 DO  
 DP  
 DQ  
 DR  
 DS  
 DT  
 DU  
 DV  
 DW  
 DX  
 DY  
 DZ  
 EA  
 EB  
 EC  
 ED  
 EE  
 EF  
 EG  
 EH  
 EI  
 EJ  
 EK  
 EL  
 EM  
 EN  
 EO  
 EP  
 EQ  
 ER  
 ES  
 ET  
 EU  
 EV  
 EW  
 EX  
 EY  
 EZ  
 FA  
 FB  
 FC  
 FD  
 FE  
 FF  
 FG  
 FH  
 FI  
 FJ  
 FK  
 FL  
 FM  
 FN  
 FO  
 FP  
 FQ  
 FR  
 FS  
 FT  
 FU  
 FV  
 FW  
 FX  
 FY  
 FZ  
 GA  
 GB  
 GC  
 GD  
 GE  
 GF  
 GG  
 GH  
 GI  
 GJ  
 GK  
 GL  
 GM  
 GN  
 GO  
 GP  
 GQ  
 GR  
 GS  
 GT  
 GU  
 GV  
 GW  
 GX  
 GY  
 GZ  
 HA  
 HB  
 HC  
 HD  
 HE  
 HF  
 HG  
 HH  
 HI  
 HJ  
 HK  
 HL  
 HM  
 HN  
 HO  
 HP  
 HQ  
 HR  
 HS  
 HT  
 HU  
 HV  
 HW  
 HX  
 HY  
 HZ  
 IA  
 IB  
 IC  
 ID  
 IE  
 IF  
 IG  
 IH  
 II  
 IJ  
 IK  
 IL  
 IM  
 IN  
 IO  
 IP  
 IQ  
 IR  
 IS  
 IT  
 IU  
 IV  
 IW  
 IX  
 IY  
 IZ  
 JA  
 JB  
 JC  
 JD  
 JE  
 JF  
 JG  
 JH  
 JI  
 JJ  
 JK  
 JL  
 JM  
 JN  
 JO  
 JP  
 JQ  
 JR  
 JS  
 JT  
 JU  
 JV  
 JW  
 JX  
 JY  
 JZ  
 KA  
 KB  
 KC  
 KD  
 KE  
 KF  
 KG  
 KH  
 KI  
 KJ  
 KK  
 KL  
 KM  
 KN  
 KO  
 KP  
 KQ  
 KR  
 KS  
 KT  
 KU  
 KV  
 KW  
 KX  
 KY  
 KZ  
 LA  
 LB  
 LC  
 LD  
 LE  
 LF  
 LG  
 LH  
 LI  
 LJ  
 LK  
 LL  
 LM  
 LN  
 LO  
 LP  
 LQ  
 LR  
 LS  
 LT  
 LU  
 LV  
 LW  
 LX  
 LY  
 LZ  
 MA  
 MB  
 MC  
 MD  
 ME  
 MF  
 MG  
 MH  
 MI  
 MJ  
 MK  
 ML  
 MM  
 MN  
 MO  
 MP  
 MQ  
 MR  
 MS  
 MT  
 MU  
 MV  
 MW  
 MX  
 MY  
 MZ  
 NA  
 NB  
 NC  
 ND  
 NE  
 NF  
 NG  
 NH  
 NI  
 NJ  
 NK  
 NL  
 NM  
 NN  
 NO  
 NP  
 NQ  
 NR  
 NS  
 NT  
 NU  
 NV  
 NW  
 NX  
 NY  
 NZ  
 OA  
 OB  
 OC  
 OD  
 OE  
 OF  
 OG  
 OH  
 OI  
 OJ  
 OK  
 OL  
 OM  
 ON  
 OO  
 OP  
 OQ  
 OR  
 OS  
 OT  
 OU  
 OV  
 OW  
 OX  
 OY  
 OZ  
 PA  
 PB  
 PC  
 PD  
 PE  
 PF  
 PG  
 PH  
 PI  
 PJ  
 PK  
 PL  
 PM  
 PN  
 PO  
 PP  
 PQ  
 PR  
 PS  
 PT  
 PU  
 PV  
 PW  
 PX  
 PY  
 PZ  
 QA  
 QB  
 QC  
 QD  
 QE  
 QF  
 QG  
 QH  
 QI  
 QJ  
 QK  
 QL  
 QM  
 QN  
 QO  
 QP  
 QQ  
 QR  
 QS  
 QT  
 QU  
 QV  
 QW  
 QX  
 QY  
 QZ  
 RA  
 RB  
 RC  
 RD  
 RE  
 RF  
 RG  
 RH  
 RI  
 RJ  
 RK  
 RL  
 RM  
 RN  
 RO  
 RP  
 RQ  
 RR  
 RS  
 RT  
 RU  
 RV  
 RW  
 RX  
 RY  
 RZ  
 SA  
 SB  
 SC  
 SD  
 SE  
 SF  
 SG  
 SH  
 SI  
 SJ  
 SK  
 SL  
 SM  
 SN  
 SO  
 SP  
 SQ  
 SR  
 SS  
 ST  
 SU  
 SV  
 SW  
 SX  
 SY  
 SZ  
 TA  
 TB  
 TC  
 TD  
 TE  
 TF  
 TG  
 TH  
 TI  
 TJ  
 TK  
 TL  
 TM  
 TN  
 TO  
 TP  
 TQ  
 TR  
 TS  
 TT  
 TU  
 TV  
 TW  
 TX  
 TY  
 TZ  
 UA  
 UB  
 UC  
 UD  
 UE  
 UF  
 UG  
 UH  
 UI  
 UJ  
 UK  
 UL  
 UM  
 UN  
 UO  
 UP  
 UQ  
 UR  
 US  
 UT  
 UU  
 UV  
 UW  
 UX  
 UY  
 UZ  
 VA  
 VB  
 VC  
 VD  
 VE  
 VF  
 VG  
 VH  
 VI  
 VJ  
 VK  
 VL  
 VM  
 VN  
 VO  
 VP  
 VQ  
 VR  
 VS  
 VT  
 VU  
 VV  
 VW  
 VX  
 VY  
 VZ  
 WA  
 WB  
 WC  
 WD  
 WE  
 WF  
 WG  
 WH  
 WI  
 WJ  
 WK  
 WL  
 WM  
 WN  
 WO  
 WP  
 WQ  
 WR  
 WS  
 WT  
 WU  
 WV  
 WW  
 WX  
 WY  
 WZ  
 XA  
 XB  
 XC  
 XD  
 XE  
 XF  
 XG  
 XH  
 XI  
 XJ  
 XK  
 XL  
 XM  
 XN  
 XO  
 XP  
 XQ  
 XR  
 XS  
 XT  
 XU  
 XV  
 XW  
 XX  
 XY  
 XZ  
 YA  
 YB  
 YC  
 YD  
 YE  
 YF  
 YG  
 YH  
 YI  
 YJ  
 YK  
 YL  
 YM  
 YN  
 YO  
 YP  
 YQ  
 YR  
 YS  
 YT  
 YU  
 YV  
 YW  
 YX  
 YZ  
 ZA  
 ZB  
 ZC  
 ZD  
 ZE  
 ZF  
 ZG  
 ZH  
 ZI  
 ZJ  
 ZK  
 ZL  
 ZM  
 ZN  
 ZO  
 ZP  
 ZQ  
 ZR  
 ZS  
 ZT  
 ZU  
 ZV  
 ZW  
 ZX  
 ZY  
 ZZ

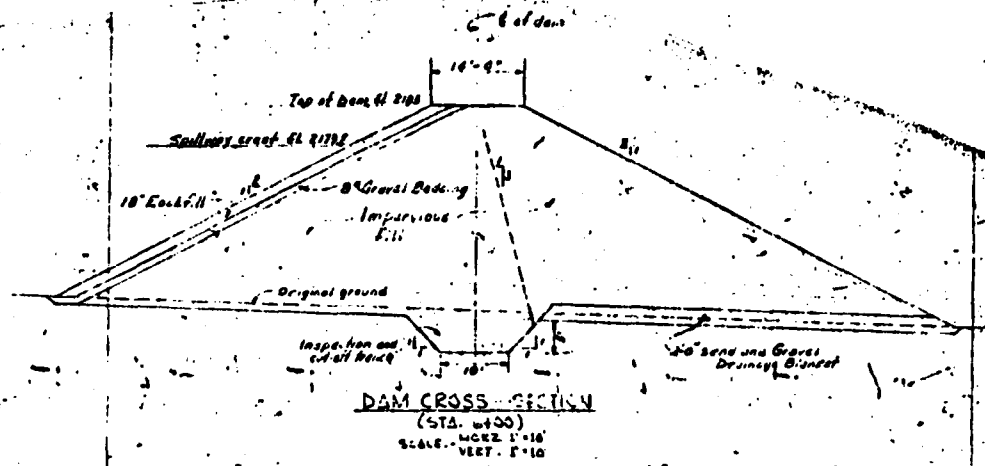
EQUINOX D&M  
SAUBERT, VERMONT

DIKE, SEE

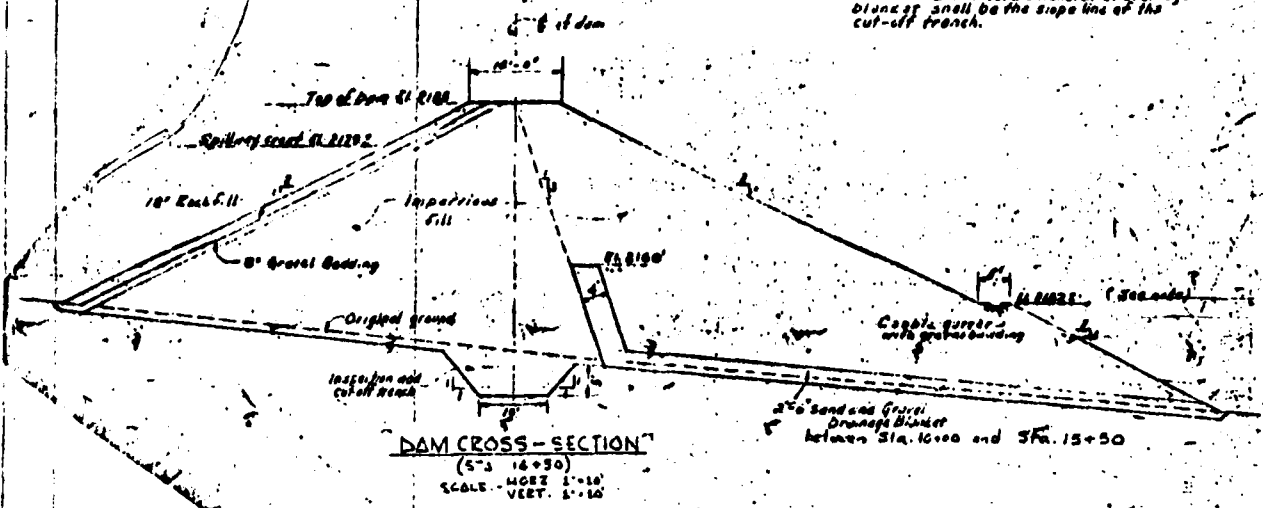
DESIGN BY  
H. P. ALDRICH and  
J. F. WELLS  
CONSULTING  
BOSTON, MASS.







**NOTE**  
Maximum upward extension of drainage blanket shall be the slope line of the cut-off trench.



- NOTES**
1. Cut-off gutter to slope 2% from high point EL 2154, sharp on plan, grading 2.
  2. On both abutments the cut-off trench shall be terminated at locations where the bottom elevation of the trench is equal to or below EL 2177.
  3. On both abutments the sand and gravel drainage blanket shall be terminated at locations where the top elevation of the blanket is equal to or below EL 2178.
  4. Core of the dam shall consist of the following:
    - (a) 8'-0" thick concrete at top of dam
    - (b) 8'-0" thick concrete at top of dam
    - (c) 8'-0" thick concrete at top of dam
    - (d) 8'-0" thick concrete at top of dam
    - (e) 8'-0" thick concrete at top of dam

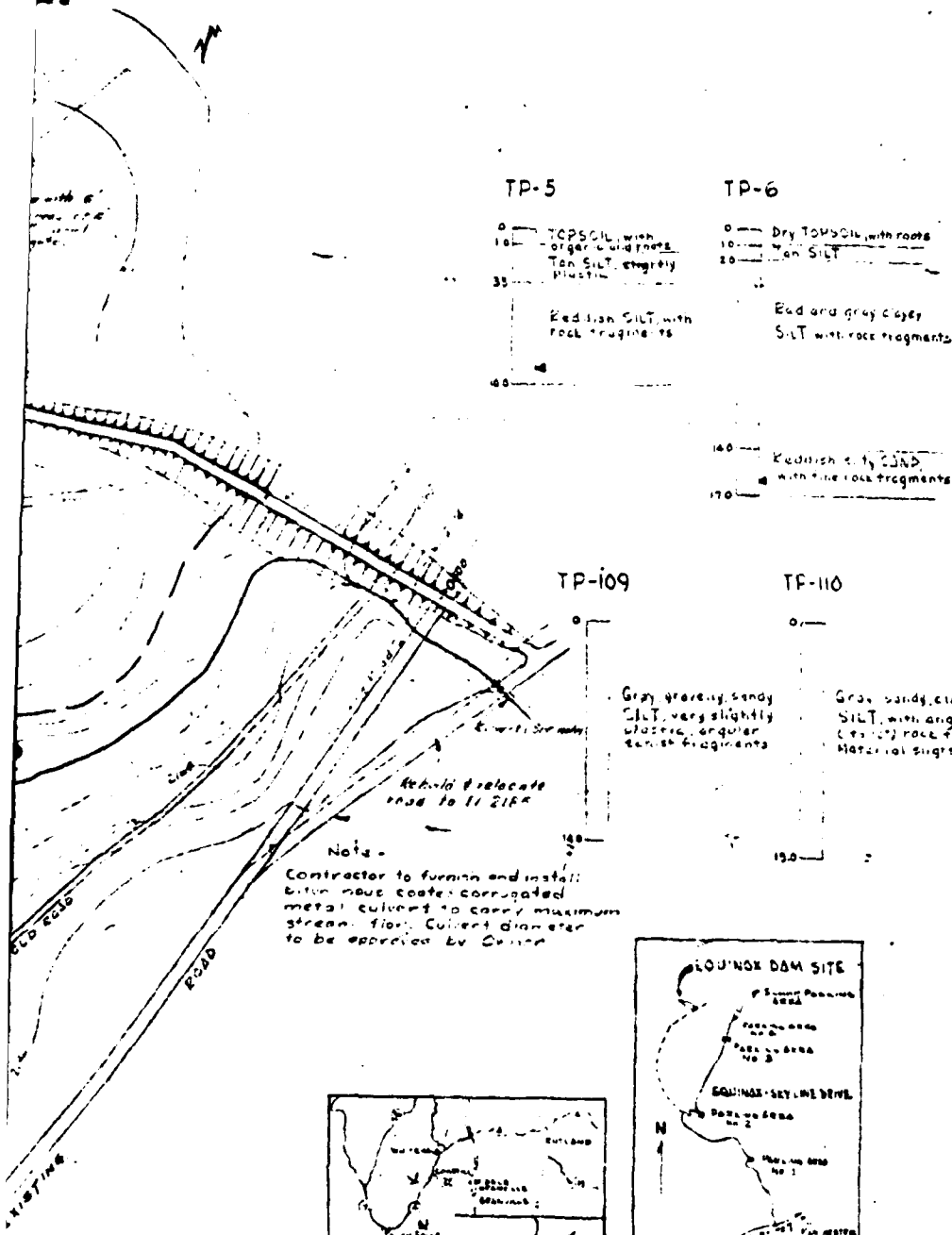
**EQUINOX DAM**  
SANDGATE, VERMONT  
AS BUILT

**LOG PROFILE AND TYPICAL DAM SECTIONS**

DESIGN BY  
H. A. ALDRICH and  
J. F. KELLY  
CONSULTING ENGINEERS  
BOSTON, MASS.

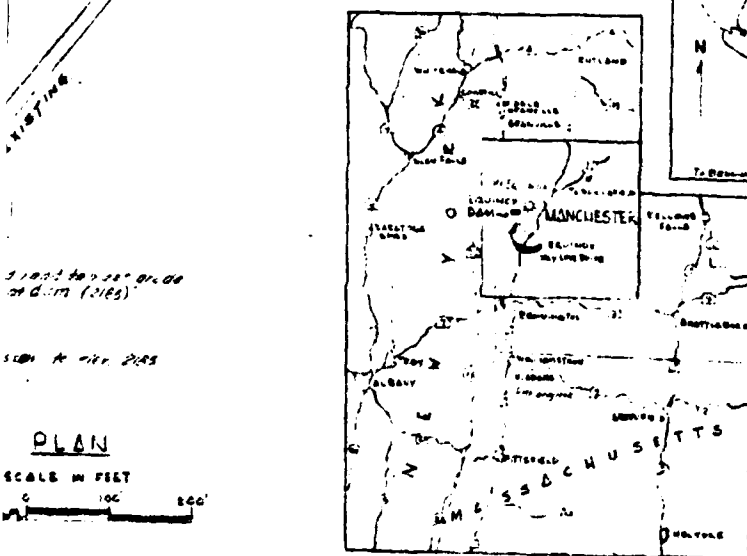
SCALE - AS SHOWN  
DATE MAY, 1930

**DRAWING NO. 2**



TP-7, TP-8 and TP-9

Gray, sandy Silt, few stones, (GSSC 10)  
Core 1 to 2' TOPSOIL with forest litter



LOCATION MAP

### NOTES

- 2 Core borings made at locations on the  
dam center line about 10 to 15 feet on either side  
of the stream to depths of 30 feet. Rock was not  
encountered.

Revised	Date	Description
1	10-25-57	As built - Core line - Incorporated
2	4-21-57	Allocate intake structure and valve tower
3	5-25-57	Revised - Spilling structure
4	6-27-57	Eliminated North Road, Extended Wood End

EQUINOX DAM  
SANGATE, VERMONT

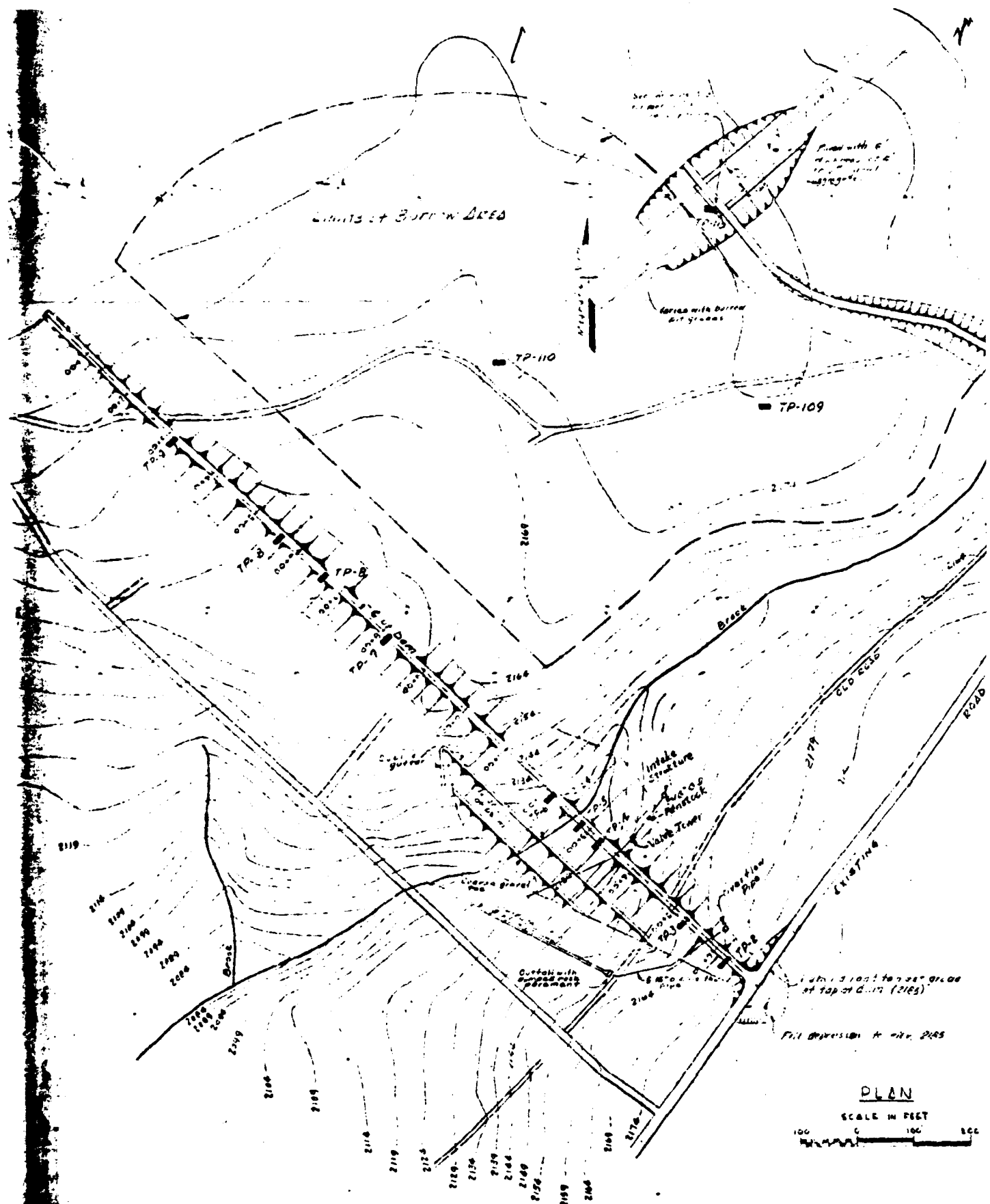
AS BUILT

GENERAL PLAN

AND  
RECORD OF EXPLORATIONS

DESIGNED BY  
J. P. GORDON and  
J. F. HALL  
CONSULTING ENGINEERS

SCALE - AS SHOWN  
DATE - NOV. 15, 1957



Summary: The three dams appear to be in good condition and well cared for, with the exception of the brush growing on the Lake Madeleine dam. The writer (per request of Mr. Harvey) informed the toll house attendant that all appeared to be in order but the brush should be out.

Photographs were taken and will be attached when developed.

APB/st

(2) Dike

(a) Upstream Slope: lower part riprapped, with vegetative cover upper part. Numerous alders and poplars were noted; These should be cut.

(b) Downstream slope: well vegetated with grass.

(3) Gate Structure: Inspected slide valve structure at bottom of manhole. Everything appears to be in order from what could be seen. There is a small amount of infiltration near valve--source could not be determined.

(4) Overflow spillway: clear of debris.

(5) Small reservoir at base of dam, and pump house No. 1 were inspected. Pump operating. Outflow from reservoir discharges via asphalt and boiler plate chute spillway. All appears to be in order.

(6) Pump House #3 upstream of Lake Madeline inspected. Pump running.

HOPPER POND DAM

This is an old concrete gravity dam approximately 36' high and 120' long set in ledge on the left hand side and tied into 45' long embankment on the right side. A notch spillway section 47' long by 1.5' deep is provided. Top width of dam and spillway is 2.0'. A gate structure with drop inlet spillway is provided. The concrete is in good condition with only minor spalling and no visible cracks. A fairly recent repair to concrete on downstream face on right side was noted.

Water level on gage on gate structure was \*\*78.9' (0.25' below main spillway crest).

Minor seepage was noted along lefthand side of downstream face of dam. There was no flow in the stream below dam--water is apparently being withdrawn via the penstock to the power house down the mountain. Inflows are from a small stream, a 3" pipe which discharges into the pond near the gate structure, and from a small reservoir above the pond (fed by overflow from Lake Madeleine). The water is very clear. Powerhouse #2 at the head of the pond was not entered but appeared to be in operation. The powerhouse uses water from Lake Madeleine and discharges into Hopper Pond.

BARBO'S LAKE DAM

This earthfill dam is in good condition with a heavy grass cover. Freeboard is about 4.5 feet. No brush was growing on slopes and no seepage was noted on downstream face. Water level was at crest of 19" drop inlet steel pipe spillway--this is about 0.2' below sill on 30' wide by 5' deep dish-shaped asphalt overflow spillway. A small stream enters the lake from the SE. The outflow from the spillway is carried downstream to Hopper Pond.

FILE COPY

State of Vermont

AGENCY OF ENVIRONMENTAL CONSERVATION

MARTIN L. JOHNSON, Secretary

Montpelier, Vermont 05602

DEPARTMENT OF WATER RESOURCES

MANAGEMENT & ENGINEERING DIVISION

August 13, 1974

Department of Fish and Game  
Department of Forests and Parks  
Department of Water Resources  
Environmental Board  
Division of Environmental Protection  
Division of Recreation  
Division of Planning  
Natural Resources Conservation Council

ROUTING		
GENERAL		
TO	NOTED	DATE
RB	APP	8/13/74
LOW	YR	8/13/74
AM	JPM	8/14/74
DHS	MR	8/14
	RHS	8-15-74
RECEIVED		
FILE		

To: A.J. Rouleau

From: A.P. Barranc *APB*

Subject: DAM INSPECTIONS--LAKE MADELEINE, BARBO'S LAKE and HOPPER POND--SANDGATE

On August 8, 1974, Larry Fitch and the writer made a routine inspection of subject dams and ancillary structures at the Mt. Equinox complex in Sandgate owned by the Carthusian Foundation (an order of Trapist Monks).

Permission to enter the property was obtained from the toll house attendant at Skyline Drive and subsequently from Mr. Fred Harvey-Acting Superintendent for the Foundation. (Mr. Bert Smith, Superintendent, was away at the time). The writer explained to Mr. Harvey that we wished to make a routine inspection of the dams, which was a part of the Division's program to make periodic inspections of impoundments throughout the state. He requested that we leave word with the toll house attendant if we found anything wrong.

The subject dams, structures and lands were left to the Carthusian Foundation after the death of Dr. Joseph G. Davidson, the previous owner, in 1969. The hydroelectric complex is still being operated as designed in 1957.

LAKE MADELEINE DAM

Water level was 2179.1 feet as measured on the gage at the gate structure--this is design spillway elevation(drop inlet pipe), and about 0.5 feet below sill on overflow spillway at the NW end of lake. The main dam, dike, overflow spillway and gate structure were inspected. The water was very clear.

(1) Main dam

(a) Upstream slope: rip-rap carried about <sup>50</sup> spillway elevation. Upper part well vegetated with grass, however, alders and poplars are also present. These should be removed.

(B) Downstream slope: well vegetated with grass. No seepage noted above toe. Substantial seepage along toe which is channeled under road at base of dam via a culvert into small reservoir. This appears to be normal seepage pro-

11/10/75

# FILE COPY

## State of Vermont



Department of Fish and Game  
Department of Forests and Parks  
Department of Water Resources  
Environmental Board  
Division of Environmental Protection  
Division of Recreation  
Division of Planning  
Natural Resources Conservation Council

ROUTING		
GENERAL		
TO	NOTED	DATE
DHS	DHS	10-29-75
DJM	DJM	10/29/75
AJR	AJR	10/29
SUSPEND TO DHS		
FILE		

### AGENCY OF ENVIRONMENTAL CONSERVATION

MARTIN L. JOHNSON, Secretary

Montpelier, Vermont 05602

DEPARTMENT OF WATER RESOURCES

MANAGEMENT & ENGINEERING DIVISION

October 28, 1975

### MEMORANDUM

To: File

From: Donald H. Spies

Subject: Lake Madeleine Dam and Barbo's Lake Dam - Sandgate

On September 16, 1975, the writer made a visual inspection of the subject structures. Mr. Burt Smith, Superintendent of Maintenance, was present during the inspection.

Overall, the dams appeared to be in good condition and stable.

#### Barbo's Lake Dam

At the time of the inspection, the slopes were being mowed. No seepage was noted and the only brush was some at the entrance to the emergency spillway. The brush was pointed out to Mr. Smith, who indicated it was scheduled for cutting.

#### Lake Madeleine Dam

This structure appeared to be in the same condition as reported last year. The brush on the embankments and in the emergency spillway was pointed out to Mr. Smith. He stated they had tried to use a brush hog to cut the growth in the spillway but there were too many stones and they damaged the blade. As for the rest, they didn't have enough people to handle all the maintenance and some things had to be put off.

The writer inquired about the leak in the gate tower. Mr. Smith said the gate is left open a crack to facilitate operation and there is a provision to drain off the water to prevent its accumulation in the tower.

During the conversation, Mr. Smith noted it had taken two years to originally fill the reservoir and that care is taken not to draw

with till structure at the opposite end of the  
impoundment. Its purpose is to prevent water from  
going into the adjacent watershed.

VERMONT DEPARTMENT OF WATER RESOURCES

INFORMATION SHEET

Name of Dam Lake Andolone Town Sandgate  
 Owner Carlusian Foundation Name of Stream Hopewell Brook  
 Address \_\_\_\_\_ Classification I

U.S.G.S. Coordinates: Lat. 43° 2' 43" Long. 73° 8' 39"

U.S.G.S. Map E West Rupert Aerial Photos VT-62-H 15-114 to 115

U.S.G.S. Elev. @ Spillway 2179

Total Length of Dam 1750 ft. Crest Width of Emergency 50 ft. \*  
 Spillway

Width of Top 14 ft. Maximum Height 64 ft.

Spillway Capacity: Principal \_\_\_\_\_ Emergency \_\_\_\_\_

Pond Area 35 A. Drainage Area 390 A.

Pond Volume: Normal Water Level 663.4 ft. Design High Water Level \_\_\_\_\_

Maximum Water Depth: Normal Water Level \_\_\_\_\_ Design High Water Level \_\_\_\_\_

Storage Before Emergency Spillway is Used Depends on amount of draw down

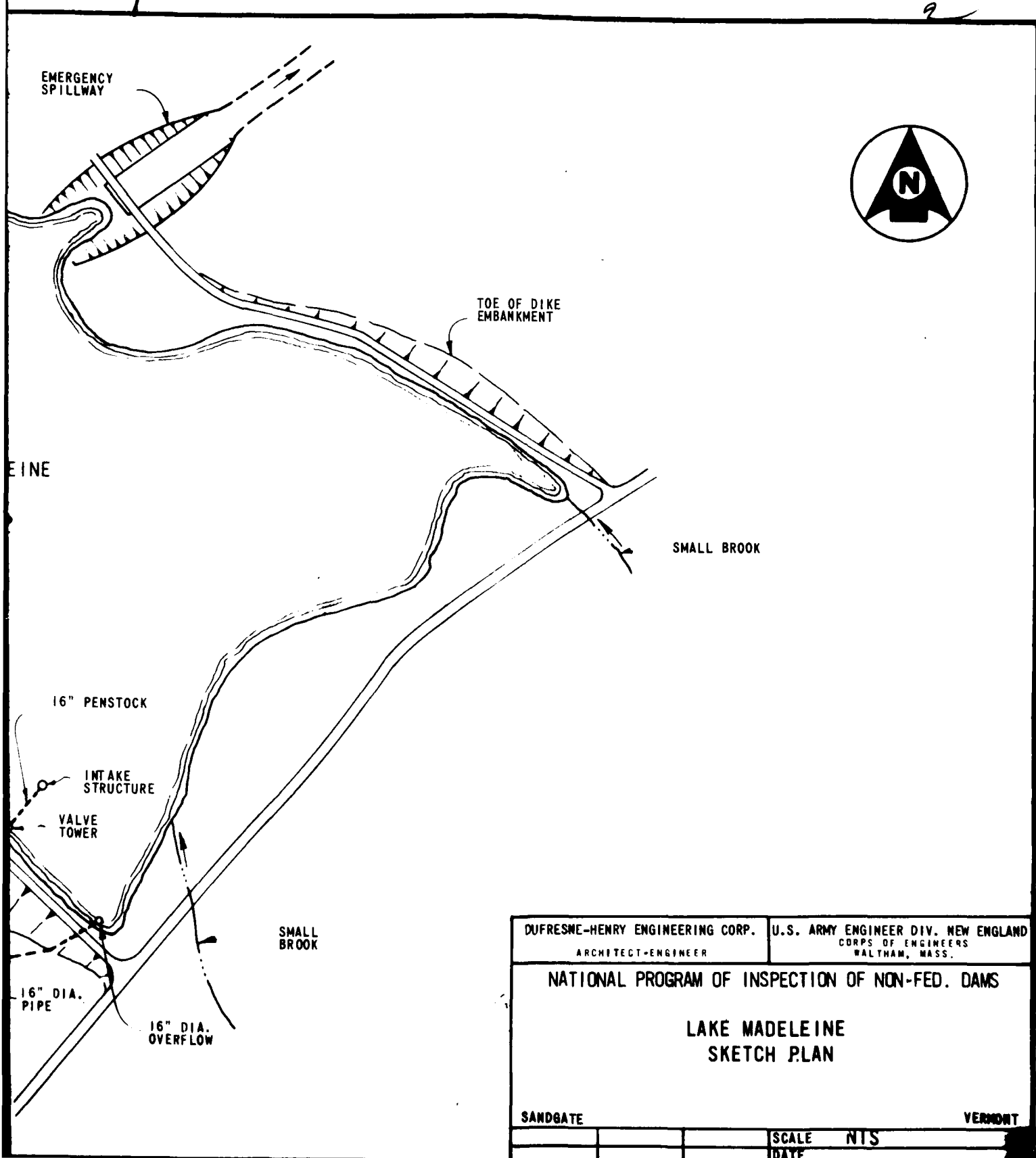
Use of Reservoir Storage for power generation

Description of Dam: Earth fill with 2 on 1 slopes on each face.

Description of Spillway(s): 1. 15 - 14" penstock with gate valve.  
E.S. 1. 14" pipe with drop inlet.  
2. earth cut with 10 on 1 side slopes. \*\*

Designed by Halley & Aldrich Year Built 1957

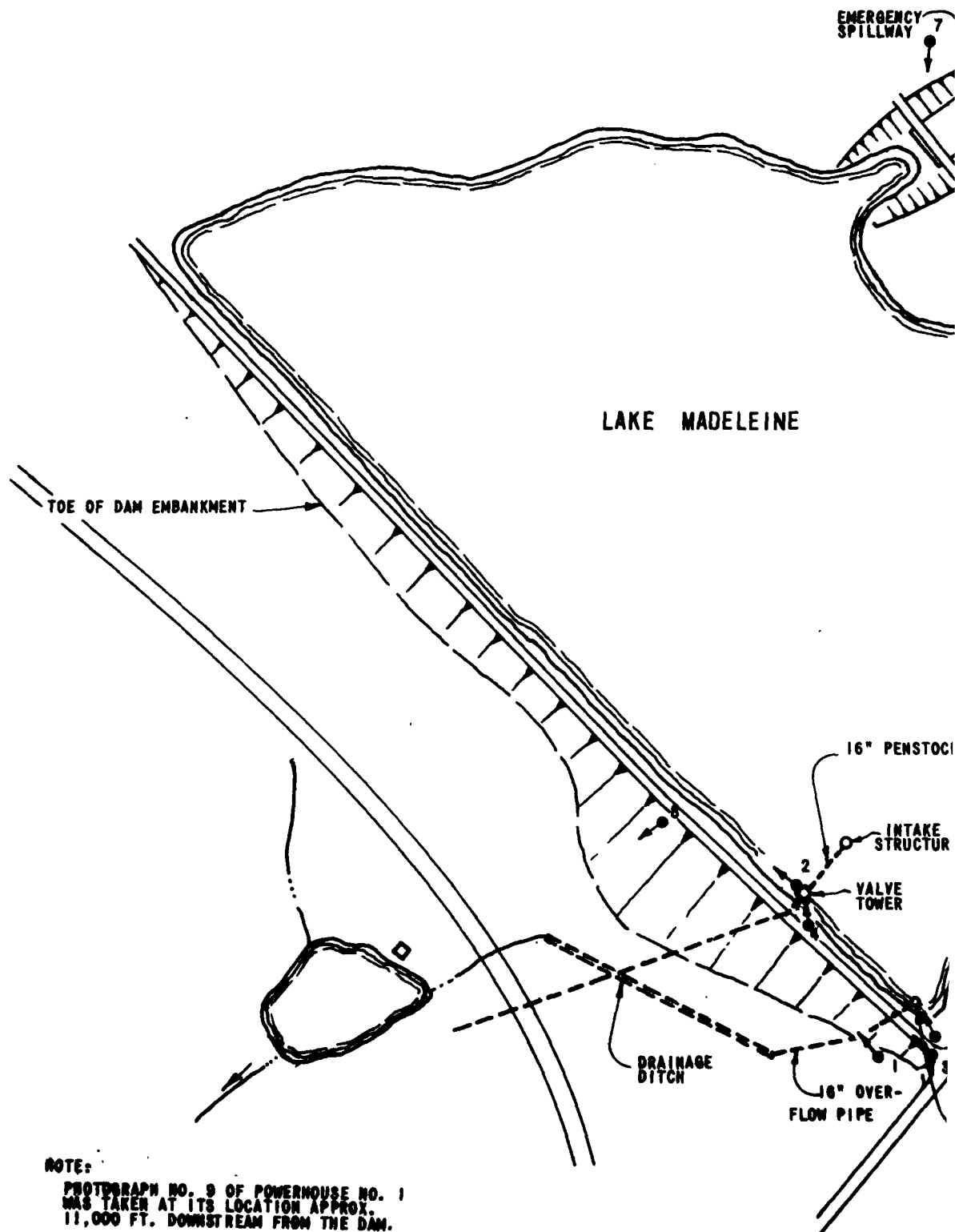
Operating Date December 4, 1956 Order Date March 1, 1957

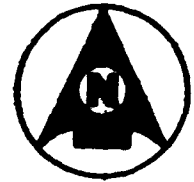
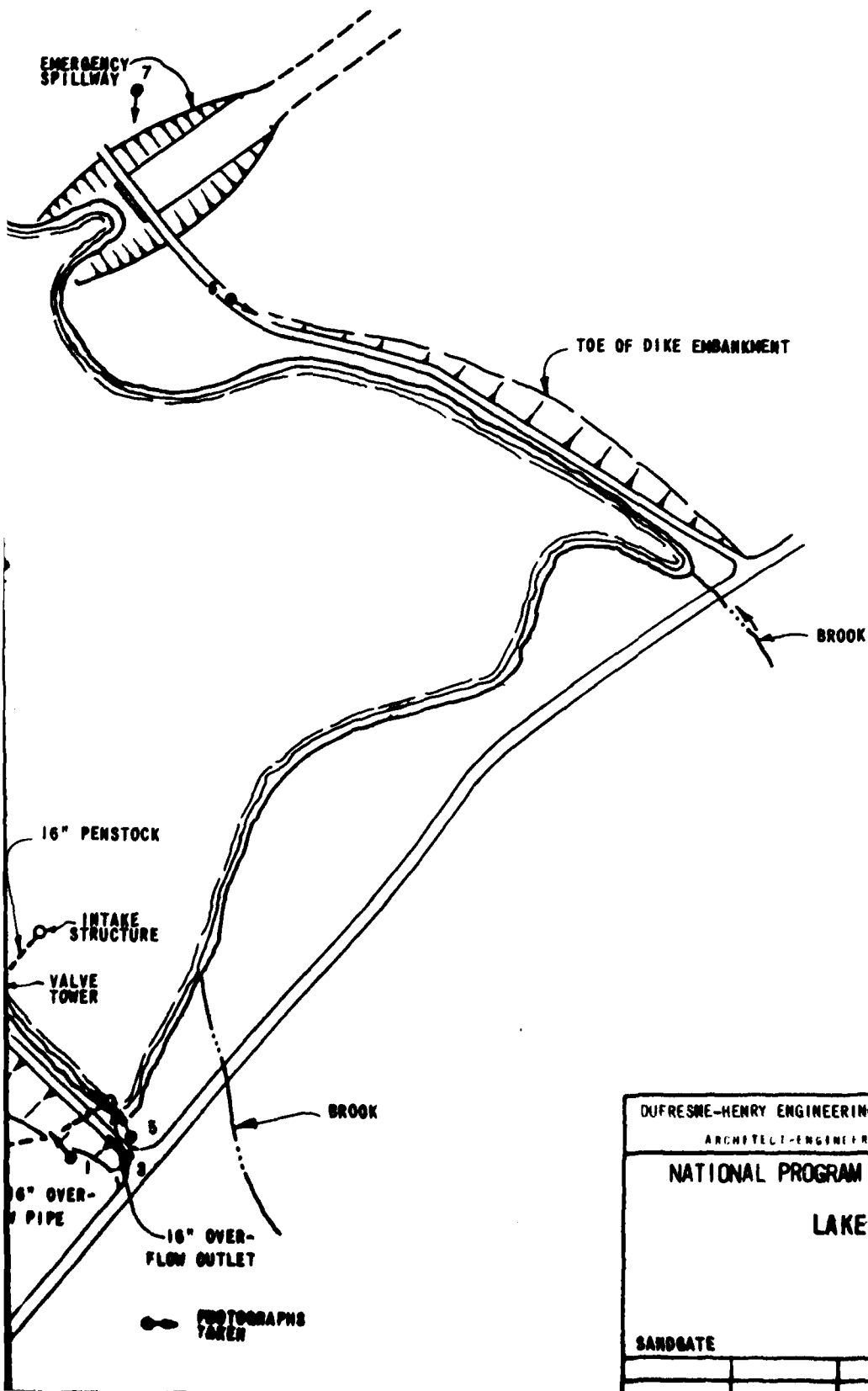


## APPENDIX C

### PHOTOGRAPHS

1. Downstream face of dam from left abutment.
2. Upstream face of dam toward right abutment from valve tower service bridge.
3. View of crest of dam from left abutment.
4. Valve tower and service bridge. Service bridge is out of alignment due to inadequate footing on the dam.
5. 16-inch diameter overflow pipe near left abutment.
6. View of dike at north end of impoundment from the left abutment.
7. Emergency spillway at north end of impoundment near left dike abutment.
8. Seepage collection pond and pumping station downstream of Lake Madeleine Dam.
9. Power House No. 1 located approximately 11,000 feet downstream of Lake Madeleine Dam.





DUFRESNE-HENRY ENGINEERING CORP.		U.S. ARMY ENGINEER DIV. NEW ENGLAND	
ARCHITECT-ENGINEER		CORPS OF ENGINEERS BALTIMORE, MARYLAND	
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS			
LAKE MADELEINE DAM			
SANDGATE		VERMONT	
		SCALE 1" = 100'	



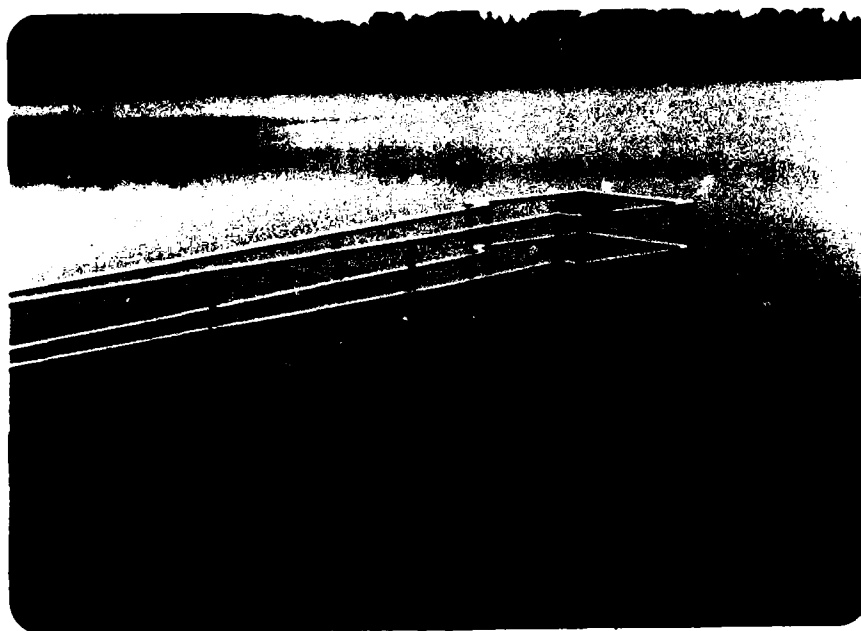
#1 DOWNSTREAM FACE OF DAM FROM LEFT ABUTMENT.



#2 UPSTREAM FACE OF DAM TOWARD RIGHT ABUTMENT FROM VALVE  
TOWER SERVICE BRIDGE.



#3 VIEW OF CREST OF DAM FROM LEFT ABUTMENT.



#4 VALVE TOWER AND SERVICE BRIDGE. SERVICE BRIDGE IS OUT OF ALIGNMENT DUE TO INADEQUATE FOOTING ON THE DAM.



#5 16-INCH DIAMETER OVERFLOW PIPE NEAR LEFT ABUTMENT.



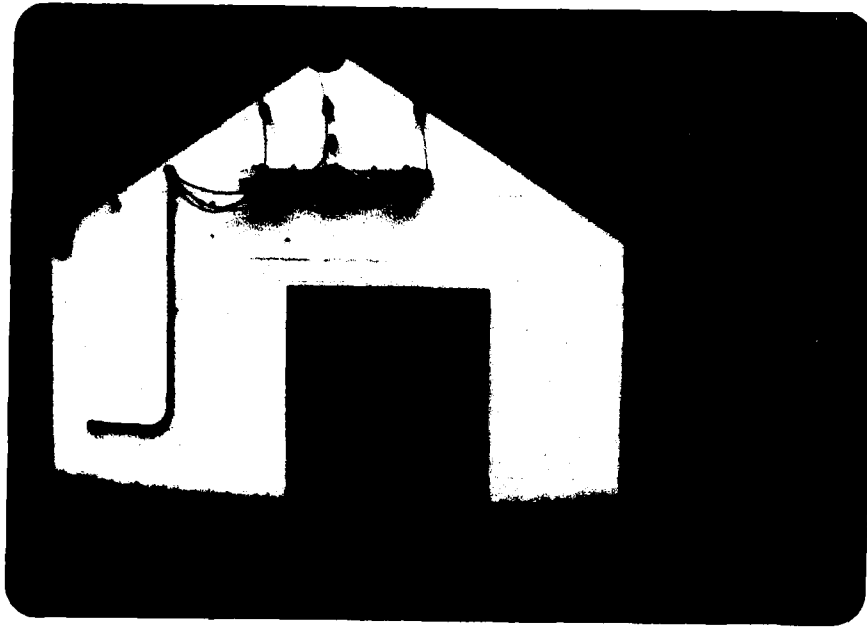
#6 VIEW OF DIKE AT NORTH END OF IMPOUNDMENT FROM THE LEFT ABUTMENT.



#7 EMERGENCY SPILLWAY AT NORTH END OF IMPOUNDMENT NEAR LEFT DIKE ABUTMENT.



#8 SEEPAGE COLLECTION POND AND PUMPING STATION DOWNSTREAM OF LAKE MADELEINE DAM.



#9 POWER HOUSE No. 1 LOCATED APPROXIMATELY 11,000 FEET  
DOWNSTREAM OF LAKE MADELEINE DAM.

**APPENDIX D**  
**HYDRAULIC COMPUTATIONS**

## LAKE MADELEINE DAM - HYDROLOGY

### Selection of Test Flood

Height of Dam ( $\bar{C}$  Dam,  $\bar{C}$  Stream Bed) 64 feet

Storage 663 Acre-feet

Intermediate Size: Height  $\geq$  40 feet

Hazard Potential: Low

Low Hazard and Intermediate Size: Use 100-year to 1/2 PMF

### Drainage Area

180 Acre natural

160 Acre diversion

340 Acre total

Land cover - good woods on Nassau<sup>D</sup> - Dutchess<sup>B</sup> soils

Slope -  $(3410-2178)/4400 = .28 \text{ feet/foot} \approx 28\%$

$(3240-2320)/3300 = .28 \text{ feet/foot} \approx 28\%$

Soil description - steep, shallow, well drained on slate uplands.

### Use SCS EFM and 100-year test flood

Average hydrologic soil group - C

Wood cover - CN70 shift to CN85 for wet antecedent condition

100-year 24-hour rainfall - 5.8 inches

Drainage area - 340 Acres

Slope - steep (28%)

From ES-1027, sheet 20 of 21,  $Q = 1100 \text{ cfs}$  for 16% slope

From SCS-TP-149, 210, Exhibit 2-0, factor = 1.18

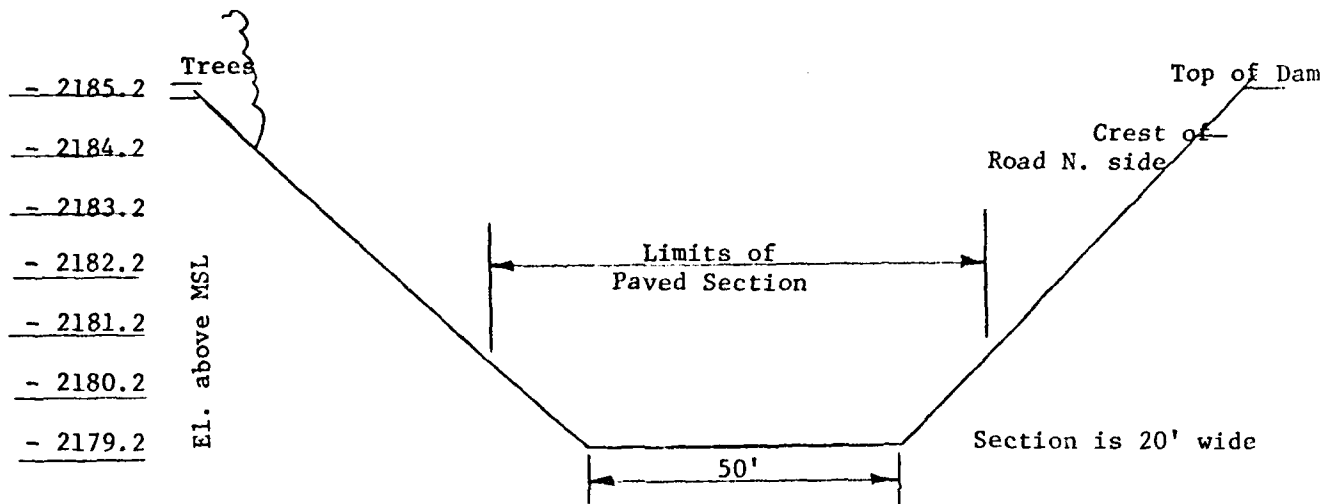
$Q_{\text{Peak Inflow}} = 1100 \times 1.18 = 1300 \text{ cfs}$

Adjust for pond at design point (majority of flow exits over weir)

$D.A./\text{Pond} = 340/35 = 9.7 (10)$ ; factor = .68;  $Q_{\text{out}} = (.68)(1300) = 884 \text{ cfs}$   
Test Flood Q

# LAKE MADELEINE DAM - HYDRAULICS

## Emergency Spillway



$$Q = CAH^{1/2}$$

Scale: H 1" = 30'  
V 1" = 3'

Stage	H	C	A	Q	Stage	H	C	A	Q
2179.7	0.5	2.70	27.9	75.3	2185	5.8	2.63	632	4003
2180.2	1.0	2.63	60.9	160	2183.2	4	2.63	363.9	1914
2181.2	2.0	2.63	141.9	528	2184.2	5	2.63	504.9	2969
2182.2	3.0	2.63	242.9	1106					

## Tailwater at Emergency Spillway

$Q = K 5^{-1/2}$		$S = 1.8' / 100'$		$K = \frac{1.486}{n}$		$A R^{2/3}$	
H=3'	A=243 WP=111 R= 2.19	$R^{2/3}=1.69$	n= .15 K= 4068	Q= 546			
			n= .035 K=17434	Q=2339			
H=4'	A=364 WP=131 R= 2.78	$R^{2/3}=1.98$	n= .15 K= 7139	Q=958			
				Q=4106			

∴ Thick brush must be cut to restore control to weir;  
e.g., road section.

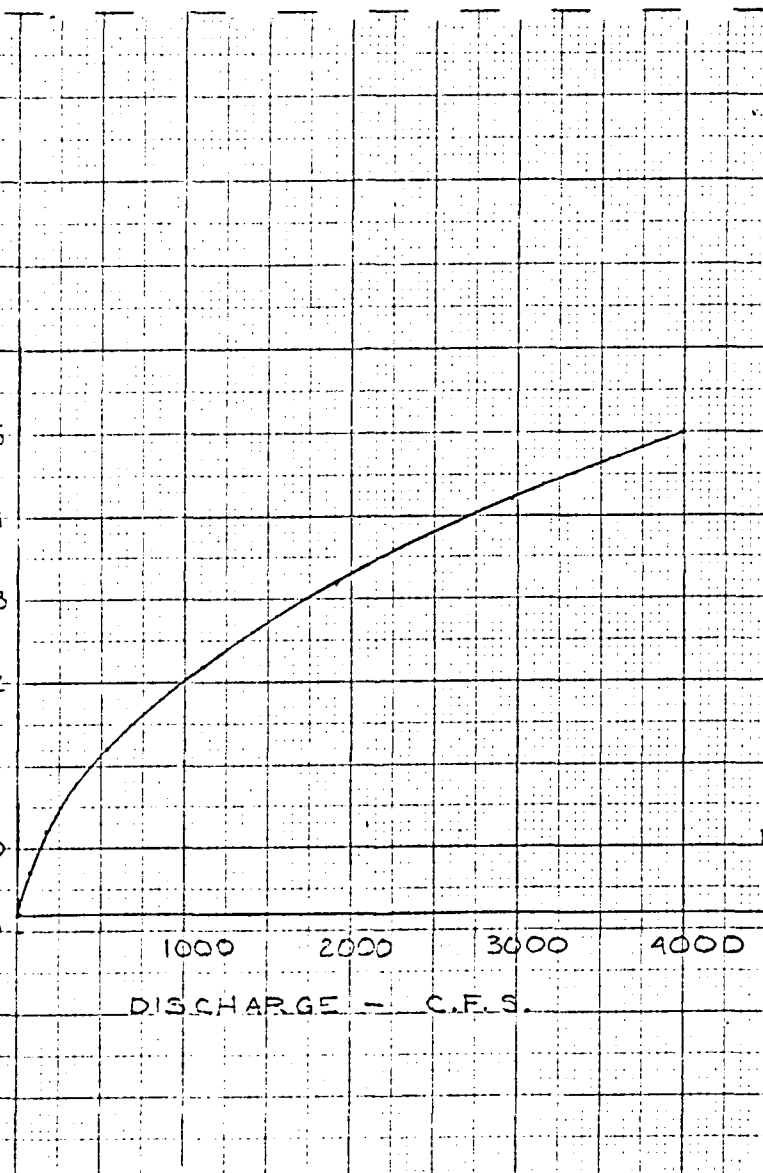
STAGE - FEET ABOVE M.S.L.

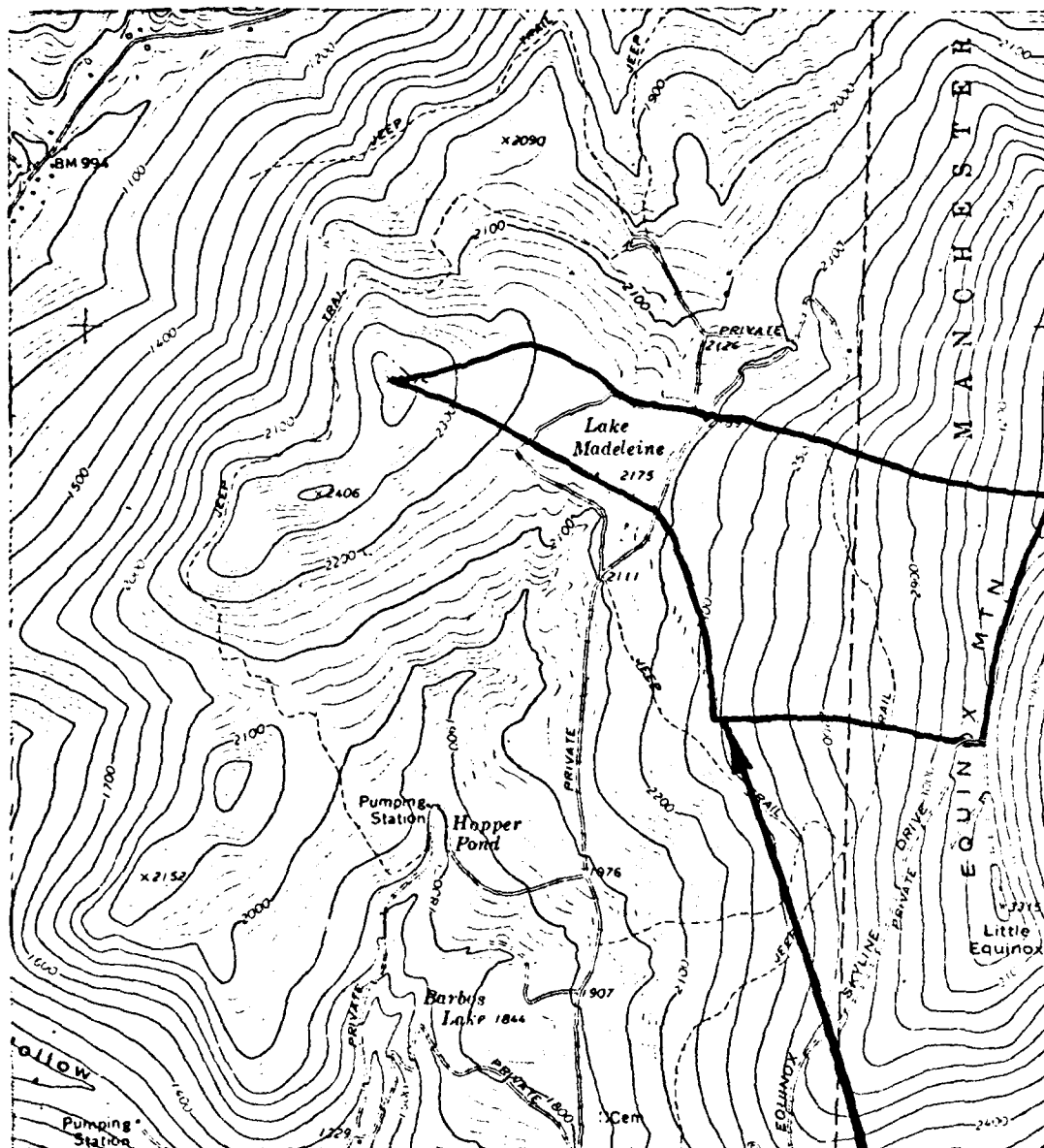
2185  
2184  
2183  
2182  
2181  
2180  
2179

1000 2000 3000 4000  
DISCHARGE - C.F.S.

RATING CURVE  
LAKE MADELEINE  
EMERGENCY SPILLWAY

Sheet No. 3 of 3  
Job No. 22-0552





# LAKE MADELEINE WATERSHED

## SOURCE OF MAP

US GEOLOGICAL SURVEY  
WEST RUPERT QUADRANGLE  
VERMONT  
7 1/2 MIN. SERIES  
1:24000 1967

CLIENT NO	22-0552	DUFRESNE-HENRY ENGINEERING CORP. LAKE MADELEINE	
PROJ ENG	MRP		
DRAWN BY	RB		
DATE	9-5-78	SANDGATE	VERMONT A 6033

APPENDIX E

Information as Contained in the National Inventory of Dams

## INVENTORY OF DAMS IN THE UNITED STATES

	<b>REMARKS</b>

END

DATE  
FILMED

9 - 85